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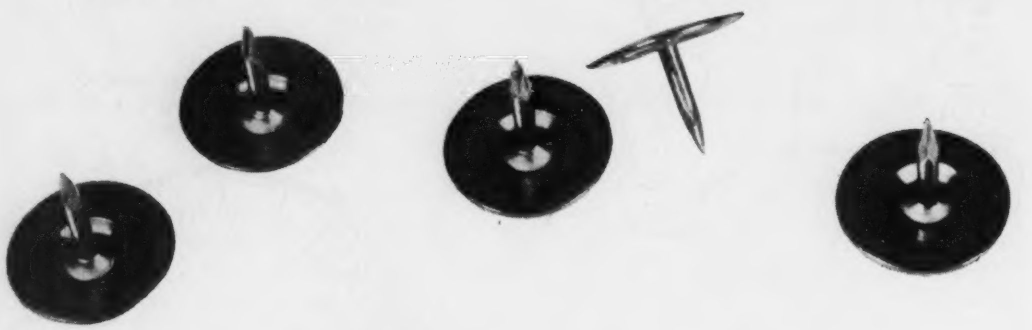
LET'S GET DOWN TO BRASS TACKS



Just why getting down to brass tacks should mean abandoning the preliminaries and getting down to business, no one knows positively. The only plausible explanation traces the expression to early dry-goods stores.

Piece goods were, of course, sold by the yard, and merchants found it convenient to put tacks in the edge of the counter to indicate a yard, half-yard, and quarter-yard. Only brass-headed tacks resisted rust, remained clearly visible.

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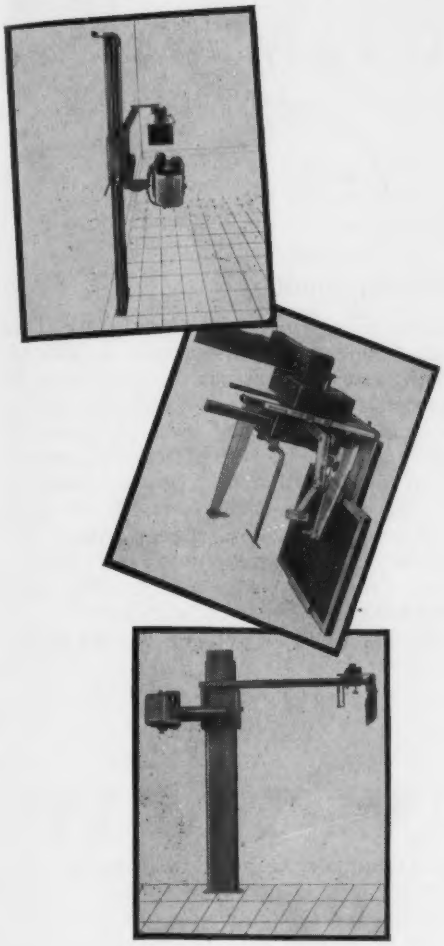

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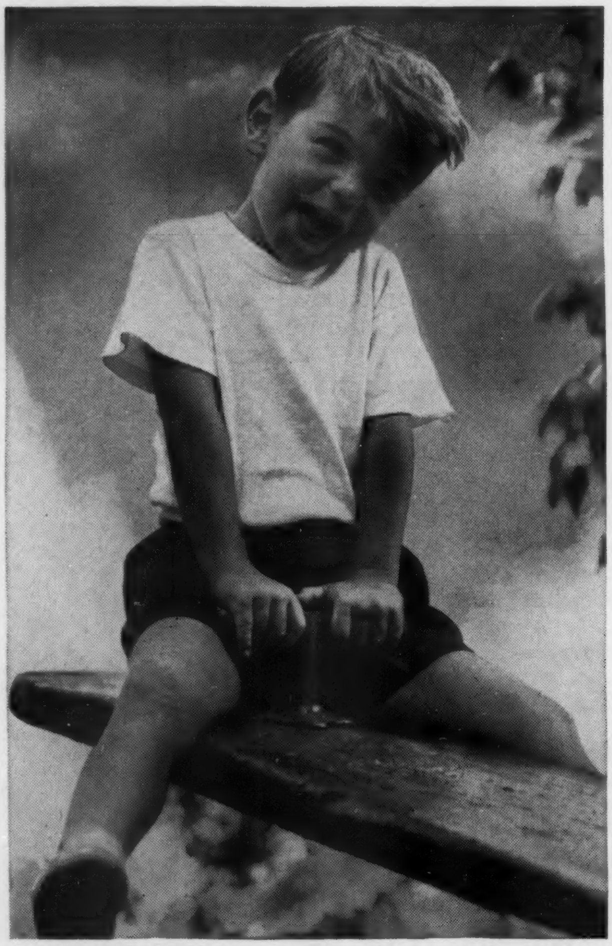

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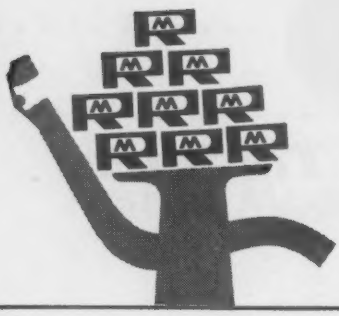

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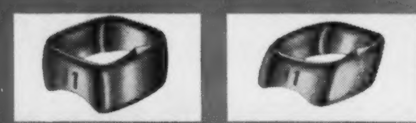

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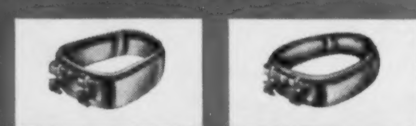

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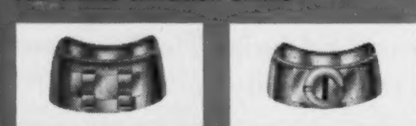

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American Journal
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VOL. 47 MAY, 1961 No. 5

Original Articles

PRESIDENT'S ADDRESS, AMERICAN ASSOCIATION OF ORTHODONTISTS

WILLIAM R. HUMPHREY, D.D.S., DENVER, COLO.

IT IS indeed a pleasure for me to welcome you to the fifty-seventh annual meeting of the American Association of Orthodontists. This is the third time that the A.A.O. has met in Colorado, but the first time that we have met in Denver.

Denver was the home town of Albert H. Ketcham, and I think it only proper that we pay tribute to him at this time. Dr. Ketcham was the father of the American Board of Orthodontics, and it was through his efforts that the Board was established in 1929 at the first Colorado meeting of the A.A.O. in Estes Park when Dr. Ketcham was president of the Association. Also worthy of mention is the fact that Dr. Ketcham started the practice of orthodontics in Denver in 1902. In the early 1900's Denver became one of the key cities of orthodontic thought and education in America. There were not more than two dozen such spots in the United States. Since Dr. Ketcham was always interested in the education of orthodontists, a great many men in this area owe their professional success and advancement chiefly to his efforts. One such man was the late Archie Brusse, who was president of the American Association of Orthodontists when we met at the Broadmoor Hotel in Colorado Springs in 1946. Dr. Ketcham has influenced the lives of a great many western orthodontists, and no meeting of the American Association of Orthodontists in this area would be complete without credit being given to this great pioneer who did so much for the development of orthodontics in this part of the country.

Another pioneer orthodontist of this area is Henry Hoffman, the honorary chairman of this meeting, who was one of Dr. Ketcham's contemporaries.

Presented at the annual meeting of the American Association of Orthodontists, Denver, Colorado, April 17, 1961.

Without doubt, Dr. Hoffman has contributed more to dentistry in this state than any living Colorado dentist. He is now in his ninetieth year and still goes to his office occasionally. Dr. Hoffman has been given many honors, including the title of "Most Outstanding Dentist in Colorado," during the first half of the present century. The last of these honors and perhaps one of the greatest, came when he was named chairman of the History Committee which published a volume entitled *The History of Dentistry in Colorado.* This book was published in 1959, during our state's centennial year, and it was awarded a Certificate of Merit by the American Association for State and Local History.

I now want to discuss with you some of the accomplishments of the American Association of Orthodontists, as well as some of the areas of investigation in which we are working. Also, I have several recommendations to make.

During our sixty years of existence, we have been able to achieve high public esteem and appreciation of our services. It is my hope that, with the increased membership and the increased number of orthodontists taking their places on the American scene, we will be able to continue to merit the public acceptance which we have enjoyed in the past. In addition to being the standard bearer for improved health service to the public, the American Association of Orthodontists has been the greatest educational instrument for orthodontists throughout the world as well as for its own individual members.

Our very excellent JOURNAL, which to my mind is one of the best professional journals published in America, has recorded much of the information generated by our eight constituent societies and our national organization. The editor of the JOURNAL, his associates, and the editorial board deserve a great deal of credit.

Through our Association's qualifying Committee, we have been able to upgrade our training under the preceptorship program, and until the program is ended it would seem to me that everything has been done that could possibly be done to protect the public and to improve the opportunities for our associate members to obtain the ultimate skill and ability which will permit them to become members of the American Association of Orthodontists.

This brings me to the subject of orthodontic education. It is certain that the Council on Dental Education of the American Dental Association, in collaboration with each of the respective specialties, should promptly establish criteria for educational standards in each of the specialties. It would be too much to expect that each of the graduate courses should be of equal standards, and it is foolish to assume that this could ever come to pass. However, minimum standards should be established as quickly as possible. I realize fully that minimum standards cannot be established in a short period of time; this will require considerable study by all those involved.

In discussing some of the more recent accomplishments of the Association, it is important that attention be called to the Washington meeting. A great deal was accomplished at this meeting. Of major importance was the establishment of our central office. Also, the Board of Directors approved an

increase in dues which will permit us to conduct our Association matters in a manner in keeping with our growth and importance. A great many associations, some smaller than our own, have availed themselves of public relations counsel, convention management, and many services that we should consider and adopt. All of these things were advocated by Dr. Martinek at the Detroit meeting and by Dr. Anderson at the Washington meeting. Some of these needs have been realized.

General Chairman Carman and his committee have employed the St. Louis firm of Professional Associates under the direction of Mr. Fred Kettlekamp. We will have an opportunity at this Denver meeting to appraise the value of such assistance. In the future, most of the things which the local committees have had to do can probably be done by a convention management organization.

Another recent accomplishment which was brought to successful fruition at Dr. Martinek's meeting in Detroit was our new insurance program. Now with the appointment of a standing Insurance Committee, it is quite probable that more insurance plans, which will be beneficial to all of the members, will be worked out.

As I have said, the greatest accomplishment of the American Association of Orthodontists over these many years has been its educational program, which should always be our first consideration. However, our membership is now becoming large enough to require some better organizational plans. I would suggest, for instance, that the central office handle much that the Local Arrangements Committee has been taking care of, and that all requests pertaining to registered-attendance clinics, social events, etc., be mailed to the central office rather than to the General Arrangements Committee at each convention city. This plan, of course, would permit the secretary-treasurer of the American Association to take care of all monies collected and spent for the annual convention, and it would do away with the necessity for a local treasurer.

Before going into the areas of investigation, I would like to speak of two other matters.

First, it was Mrs. Humphrey's and my pleasure to visit seven of the eight constituent societies of the American Association of Orthodontists this past year. I am of the opinion that all of the constituents are operating well and that it should never be the policy of the American Association of Orthodontists to interfere in any way with their operation. As I traveled about the country, however, I saw some things which might be used by all the constituents. For example, I would earnestly urge that each of the constituent societies have an induction ceremony for new members.

The trips to the constituent society meetings were strenuous but most rewarding. Both Mrs. Humphrey and I felt that we could not have been received with more hospitality and genuine friendliness at these meetings.

Most of the constituent societies insisted that I accept expenses for my trips to their meetings. It might be well for the American Association of

Orthodontists to consider assuming the expense of sending the president to these constituent society meetings, as well as the administrative secretary, when he is employed. In my opinion, this would greatly enhance the operation of the central office and facilitate the constituent secretaries' duties.

The second thing I wish to mention is that each new member should seek certification by the American Board of Orthodontics as soon as possible. There is probably no better way to upgrade our specialty than to have it known that a large proportion of our membership has been certified by our American Board. This would probably be one of the greatest deterrents to those who dabble in the field of orthodontics and present themselves as orthodontists when they are not prepared to treat cases properly.

When the new graduate or preceptor-trainee starts his own practice, he should begin at once to keep excellent records, good photographs, good x-rays, good casts, and cephalometric tracings (if he is so trained and wishes to use cephalometric techniques), so that soon he will have material to present to the Board.

When I was a director of the Board, a great many young men asked me if it was necessary to have the first photographs or if they could present cases in which all of the diagnostic material was not available. Of course, this is a difficult question to answer, but I would urge all new members to start accumulating complete records—not just for the purpose of having material to present to the Board but because this is the proper way to conduct a practice.

I now want to discuss the matter of Resolution 2 of the Council on Dental Education of the American Dental Association, which would, in effect, put the regulation of specialty associations, academies, and boards under the direction of the American Dental Association. This resolution follows:

> *"RESOLVED, that after January 1, 1965, all members who announce themselves to the public as specialists and as limiting their practices in one of the areas approved by the American Dental Association be required to hold a certificate from a national certifying board approved by the American Dental Association or a state license permitting announcement in one of the areas approved by the American Dental Association."*

Resolution 2, of course, is not necessarily something that is not to be considered good and worth while. Our objection was simply that this resolution was ambiguous, not properly worded, and too hastily prepared. We opposed it because it would have interfered with the operation of our Board and our Association.

I made a trip to Los Angeles and found that President-Elect McCauley had things well in hand long before I arrived. We were organized and presented a united front in opposition to Resolution 2, as did practically all members of every specialty. The Reference Committee then postponed action on Resolution 2 for one year. Immediately after the postponement, I appointed a special committee known as the American Dental Association

Liaison Committee of the American Association of Orthodontists. This Committee, under the chairmanship of Nat Gaston, has been extremely busy working out a solution to the problems presented by Resolution 2. I attended their meeting in January in Chicago, and never have I seen more dedicated men. They worked into the small hours of the night trying to prepare a report which would both meet with the approval of the Council on Dental Education and satisfy our needs. Such a report has now been prepared and will be submitted to the American Dental Association. In time, the Liaison Committee, in cooperation with the Related Organizations Committee, will establish a workable plan.

Now I wish to make several recommendations:

1. That following the Los Angeles meeting, the immediate past-president be made a member of the Board of Directors of the American Association of Orthodontists and a member of the Ad Interim Committee. Certainly, no single person in the American Association of Orthodontists could have more to offer to both the Ad Interim Committee and the Board of Directors than the immediate past-president.
2. That a member of the American Board of Orthodontics be made a member of the Board of Directors of the American Association of Orthodontists.
3. That the Ad Interim Committee be given the authority to employ public relations counsel to investigate the various facets of our operation which need public relations assistance.
4. That, if the performance of Professional Associates under the management of Mr. Fred Kettlekamp, satifies the membership at the Denver meeting, this firm be employed further in the conduct of our annual session.
5. That a proper plaque be prepared and presented to the essayist who delivers the Mershon Memorial Lecture.
6. That a certificate of membership be prepared and presented to each new member of the American Association of Orthodontists when he passes from his Associate membership to Active membership.
7. That the special committee that I have appointed, known as the American Dental Association Liaison Committee of the American Association of Orthodontists, be made a standing committee and that the members now serving on this committee be maintained and asked to serve again.
8. That a new committee known as the Historical Research Committee be appointed. This committee should consist of a chairman and a co-chairman to be known as the curator of the museum and archives, plus one member appointed from each of the constituent societies—two to serve for four years, two to serve for three years, two to serve for two years, and two to serve for one year.

I wish to thank the president-elect, the vice-president, and the Ad Interim Committee. I wish it were possible for me to mention and thank each of my

committee chairmen, as well as the members of both the appointed and the elected committees. This meeting has truly been the product of the committees. I know that this has been repeated many times by many presidents, but it is probably more true at this meeting than at any meeting in our past.

There are, however, four men whom I wish to mention: (1) Lyndon Carman, my general chairman, who has devoted two years to perfecting this meeting and without whom I could not have fulfilled my duties as President; (2) Program Chairman Jack Salzmann who, with his very able committee, has prepared this outstanding program; (3) George Siersma, chairman of the Local Arrangements Committee, who has been busy with the many, many things that such a chairman has to do; and (4) Secretary Earl Shepard, who has been my right-hand man and without whom I could not have carried on the many duties which it has been my pleasure to perform.

1232 Republic Bldg.

A VARIATION OF CLASS II, DIVISION 1 TECHNIQUE

M. M. Gershater, D.D.S., White Plains, N. Y.

THE appliances to be demonstrated are variations of those used in standard techniques during certain phases of Class II, Division 1 treatment. Stainless steel is the basic material used in the construction of the appliances, which have tie brackets on the four maxillary incisors and round 0.036 inch buccal tubes soldered to the first maxillary molars.

TECHNIQUE

Retraction of the Maxillary Incisors (Fig. 1, A).—The maxillary labial arch is made of round 0.022 inch stainless steel wire. A loop placed between the maxillary central incisors prevents both excessive sliding of the arch and impingement on the interdental papilla. An end-tube sleeve (0.035 inch outer diameter by 0.023 inch inner diameter), approximately ⅛ inch long, with an 0.025 inch precious metal hook soldered to it is placed on the arch wire, so that the intermaxillary hooks are at the mesial aspect of the maxillary canine. The arch wire is crimped at the distal end of the sleeve. This crimp acts as a stop for the intermaxillary hooks, eliminating the necessity of soldering to the arch wire. The distal ends of the labial arch wire are annealed and bent toward the posterior aspect of the molar buccal tubes. This prevents both irritation to the buccal tissue and displacement of the arch wire.

Distal Movements of the Maxillary Buccal Segments (Fig. 1, B).—After the normal relationship of the maxillary incisors is established, the arch wire is removed and prepared for the distal movements of the maxillary first molars. The same arch wire as that previously employed for retraction of the maxillary incisors is used. The arch is marked and crimped just distal to the maxillary central incisor brackets. Two locks and a ½ inch spring (0.009 inch on 0.032 inch wire) are placed bilaterally distal to the intermaxillary hook sleeve. The arch wire is now ligated to the brackets. The ties for the maxillary central incisor brackets are looped into the crimps and then through the brackets to the labial arch wire. The annealed ends of the labial arch are turned slightly toward the tooth to prevent irritation of the soft tissues. The springs are then compressed by moving the distal lock 1 mm. from the mesial lock. This permits an accurate measurement of the 1 mm. pressure which Johnson advocates for

A clinic presented at the fifty-sixth annual meeting of the American Association of Orthodontists, Washington, D. C., April 24 to 28, 1960.

this type of spring. The mesial lock is then brought in contact with the distal lock, so that both locks prevent the forward movement of the spring. The intermaxillary elastics counteract the mesial action of the springs.

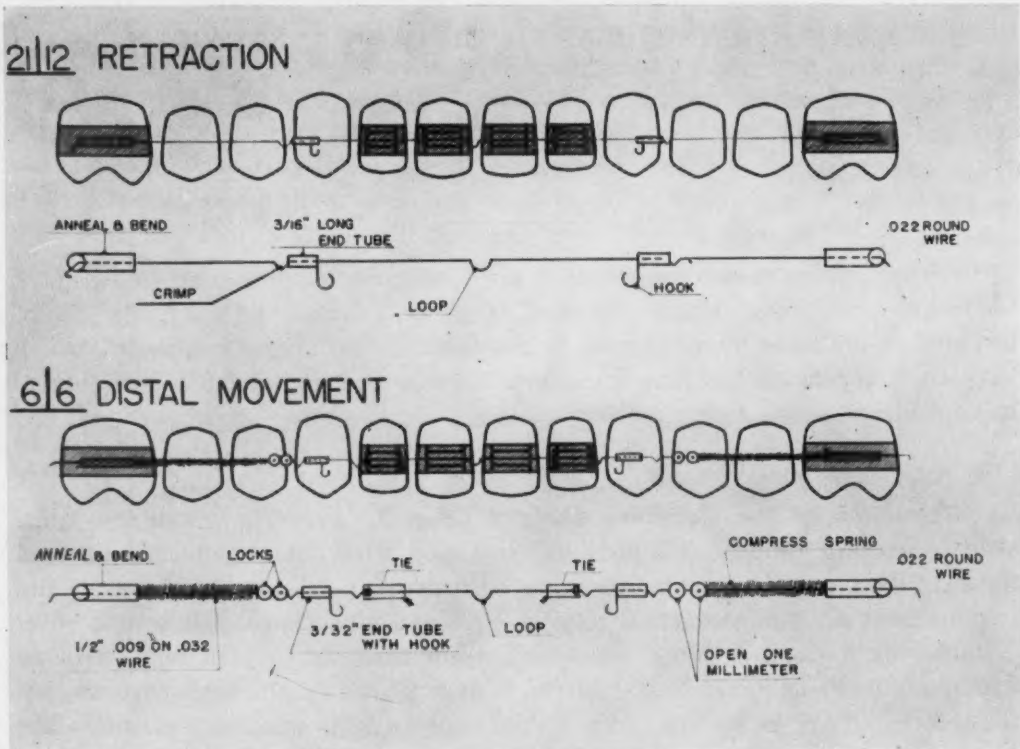

Fig. 1.—*A*, The retraction of the maxillary central and lateral incisors. *B*, The distal movement of the maxillary buccal segments.

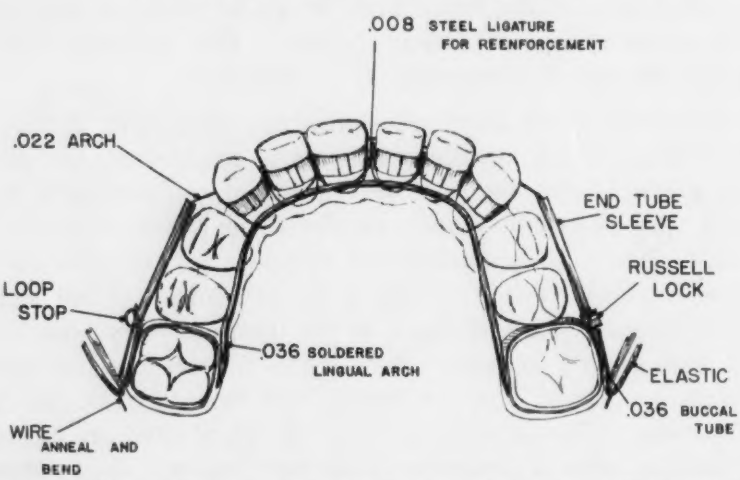

Fig. 2.—The mandibular appliance used for anchorage when intermaxillary elastics are used.

DISCUSSION

This is an extremely light, strong, resilient arch wire, which can be easily prefabricated and inserted in a minimum period of time. I have found that

there is considerably less breakage or displacement in this appliance than in those which permit free sliding of the arch wire in the molar buccal tube. The intermaxillary hooks resist breakage, since the application of excessive or abnormal forces tends to rotate the sleeve rather than to weaken the more susceptible soldered joint. During the second phase of treatment, in which the maxillary molars are moved distally, there is always accurate control of pressure against the spring. Occasionally, a maxillary protrusion may occur as a result of a patient's laxity in using elastics as prescribed. Merely deactivating the springs by moving the locks mesially makes it possible to retract the maxillary incisors again without the necessity of changing the labial arch wire.

The mandibular appliance shown in Fig. 2 is generally used when intermaxillary elastics are worn. The mandibular first molars, canines, lateral incisors, and central incisors are banded. The lingual arch, made of 0.036 inch round steel wire, is soldered to the lingual aspect of the first molar bands. The mandibular labial arch is made of 0.022 inch round stainless steel wire. A small Thompson loop is used as a stop mesial to the left mandibular first molar buccal tube. A ½ inch end tube on the arch wire supports the arch on both sides. A lock acts as the stop on the right mandibular first molar. The 0.008 inch steel ligature ties from the mandibular incisors to the 0.036 inch lingual arch may be used when additional stability is desired.

COMMENTS AND CONCLUSIONS

1. By slight modification, the arches described here can be adapted to twin arch, Universal, and edgewise techniques.

2. The arches can be prefabricated in quantity and kept in stock. With a little practice, the average operator can adapt an arch and insert it in a relatively short period of time.

3. The appliance is light and yet very sturdy. A minimum amount of time is lost because of breakage and replacement.

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NEUROMUSCULAR MECHANISMS INVOLVED IN MANDIBULAR MOVEMENT AND POSTURE

NICHOLAS A. DI SALVO, D.D.S., PH.D.,* NEW YORK, N. Y.

INTRODUCTION

FOR many years orthodontists have been aware of the importance of muscle activity in the normal development of occlusion.[1] In many instances, abnormalities of occlusion have been shown to be directly related to deranged muscle function.[2, 3] From time to time, leading clinicians have demonstrated the beneficial effects of myofunctional therapy.[4, 5] By and large, these were persons whose inquisitive natures led them to seek a better understanding of muscle function; but for the rest of us, however, mechanotherapy has remained the method of choice, and for obvious reasons. Technically, orthodontics has reached a high level of proficiency, and it seems more practical to position teeth where we want them to be by mechanical means than to rely upon the rather uncertain and unpredictable cooperation of muscles, not to mention the patient himself. Yet, we are all aware of what may occur after removal of retaining appliances when muscle dysfunction persists.[6] Fortunately, quite often the establishment of normal occlusal relations is accompanied by the development of normal muscle function. This is due to the remarkably adaptive properties of the neuromuscular system. Just how does this adaptation take place? What, if anything, can we do to promote it? This is of more than just academic interest. Before we can attempt to investigate such questions, however, we must have a thorough understanding of how this neuromuscular system functions in health.

The following examples, taken from actual orthodontic cases, illustrate problems in which the neuromuscular system may be involved in some way.

1. Anterior open-bite, associated with abnormal tongue and lip action in swallowing (Fig. 1). Every orthodontist has cases of this type in his practice.
2. Marked incisal overbite (Fig. 2)—the so-called close-bite problem which may be the result of lack of vertical development of the mandible, overeruption of anterior teeth and their alveolar processes, or both.[7, 8] In its treatment we are directly concerned with neuromuscular mechanisms inherent in the mandibular elevators.[9]

Presented before the Northeastern Society of Orthodontists, New York, New York, March 9, 1959.

*Professor and Director, Division of Orthodontics, School of Dental and Oral Surgery, Columbia University.

3. Angle Class II, Division 2 malocclusion with deep incisal overbite (Fig. 3). In the treatment of such cases man clinicians have described an unusually rapid, almost sudden, correction from a Class

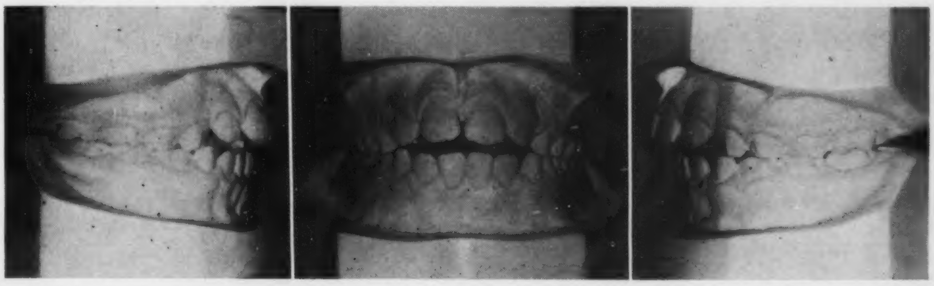

Fig. 1.—Class I open-bite associated with improper tongue function.

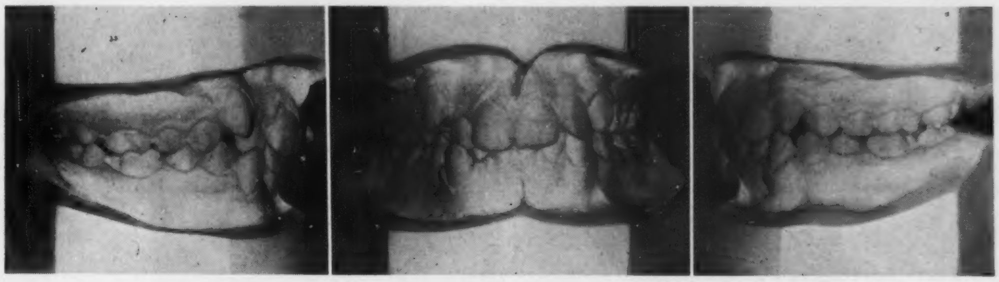

Fig. 2.—Class I malocclusion with close-bite.

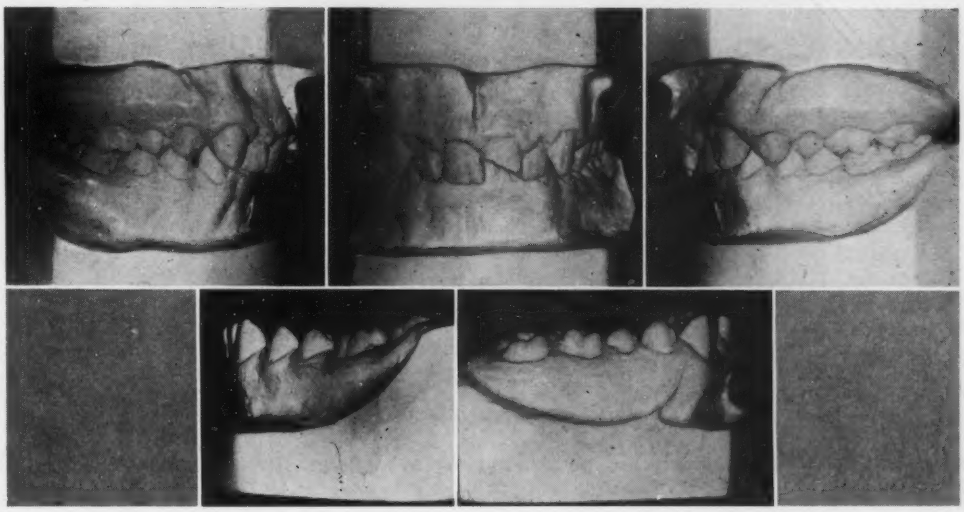

Fig. 3.—Class II, Division 2 malocclusion with deep incisal overbite.

II to a Class I relationship of the buccal segments with leveling of the occlusal table.[1] The rapidity of the change suggests a forward repositioning of the mandible, and the inference has been drawn

that the untreated malocclusion was producing and maintaining a posterior deflection of the mandible.

4. Anterior cross-bite, sometimes called the "pseudo-Class III" (Fig. 4). The differential diagnosis may be made by noting the relationship of the lower to the upper incisors when mandibular closure is stopped just short of occlusal contact. Such cases present a tip-to-tip incisal relationship which deteriorates to an anterior cross-bite as the teeth are approximated, since apparently the mandible has no choice but to slide forward in closure.[10]

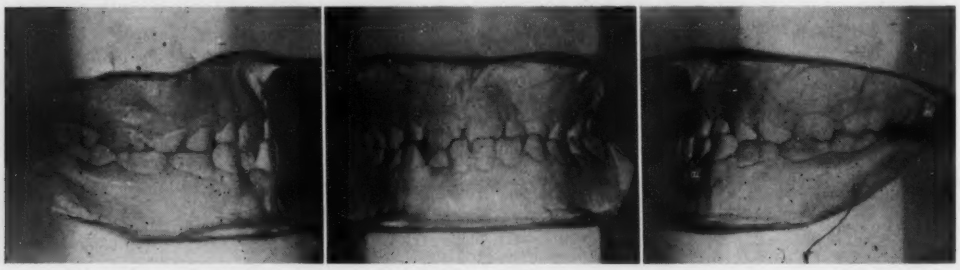

Fig. 4.—Class I malocclusion with anterior cross-bite, the "pseudo" or "functional" Class III relationship.

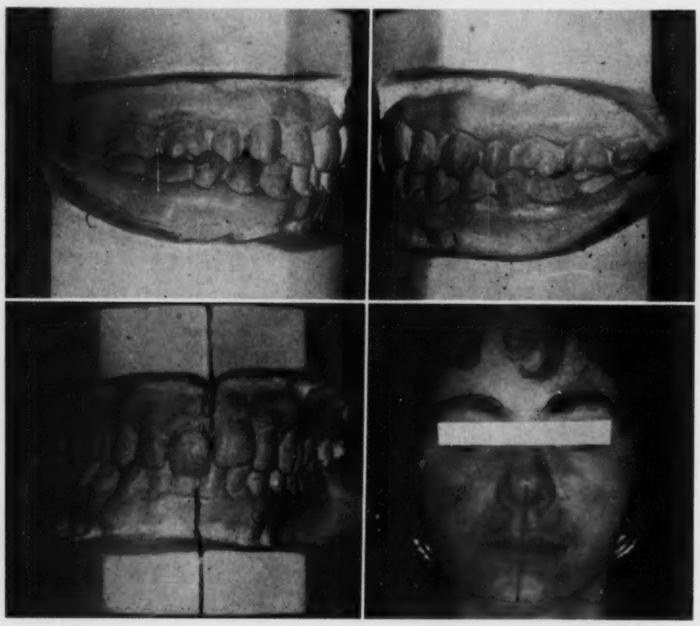

Fig. 5.—Mandibular deviation with facial asymmetry. Note the complete buccal occlusion of the upper left second and third molars, causing the mandible to be deflected to the right in closure.

5. Posterior cross-bite associated with marked lateral shifting of the mandible. Fig. 5 illustrates a case in which a 25-year-old patient shows severe facial and denture asymmetry produced by this type of occlusal disharmony of rather long standing. Often cases of posterior cross-bite appear to be unilateral, with the other side pre-

senting a good interdigitation in neutroclusion. In some of these cases, however, with correction of the unilateral cross-bite comes a mandibular shift which then necessitates a correction on the side which appeared to be normal.[10] Here, too, the inference is made that before treatment the cross-bite was producing and maintaining a mandibular eccentricity which was relieved when the involved teeth were repositioned.

Cases of the types just illustrated raise certain questions:

1. How do muscles contribute to such malocclusions?
2. What are the basic principles involved in muscle retraining?
3. If faulty muscle action is an etiological factor, should this be corrected before, during, or after corrective tooth movement by orthodontic appliances?
4. In the treatment of cases with marked incisal overbite, what corrections can we hope to maintain? Should our efforts be directed mainly toward elevating the buccal teeth or toward depressing the anterior teeth?
5. How is it that the faulty positioning of one or a few teeth will cause a sustained mandibular eccentricity? Why does the mandible not continue to function in centric position and thus force the teeth to move out of the way of interferences?

Let me state at the outset that I do not propose to give definitive answers to these questions, for I do not believe that I know what the answers are. What I do hope to do is discuss certain fundamentals which I believe bear upon these problems.

NEUROMUSCULAR MECHANISMS

Obviously, we are immediately concerned with understanding the intimate details of muscle contraction. Unhappily, however, from the standpoint of simplicity, this is not all that must be understood, for muscles are activated by nerves, and these in turn are stimulated by receptors which respond to various stimuli, and the parts are so united and regulated by central nervous system reflex activity that the system must be studied in its entirety.

Muscle.—The basic morphologic unit is the muscle fiber, which is composed of filaments of actomyosin (the myofibrils) surrounded by a membrane which is electrically charged so that the outside surface is positive with respect to the inside. The potential difference, which is in the range of 85 to 90 millivolts, constitutes the *resting potential.* The cell is normally excited by a stimulus coming from the motor nerve fiber, which is attached to it at a specialized part of the muscle membrane known as the motor end plate. The stimulus succeeds in partially depolarizing the muscle membrane at the end plate; this results in excitation, causing a propagated change in membrane potential which sweeps in a wave over the entire cell. This is the *action potential.* The membrane very quickly restores the potential to the resting level. All of this

occurs within 0.003 to 0.005 second.[11] These are the basic electrical phenomena from which electromyographic records are derived. The excitation is then transmitted to the contractile system (the fibrils) and the interdigitated actin and myosin rodlets are drawn together, thus shortening each sarcomere and hence causing the entire cell to shorten. If not stimulated again, the cell quickly resumes its original length, the entire process consuming about 0.1 second. This constitutes a single muscle twitch.[12]

Muscle is said to respond on an "all-or-none" basis. This means that when the actomyosin fibrils are activated they fold to their maximum degree of shortening. However, because of the mechanics of the system, the entire fiber does not undergo maximal shortening when activated by a single stimulus.

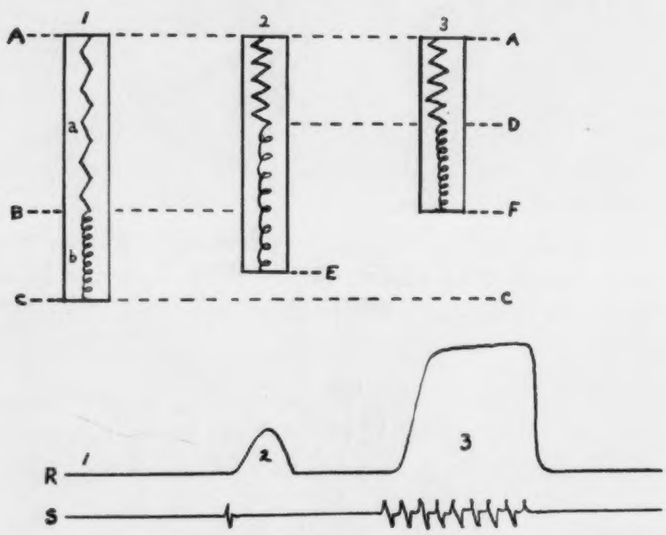

Fig. 6.—Schematic representation of muscle contraction. *1*, Muscle at rest with length *AC*; *a*, contractile element at rest with length *AB*; *b*, series elastic component at rest with length *BC*.

2, A single twitch contraction. Contractile element shortens maximally to length *AD*; elastic component extends (inertia) to length *DE*; muscle fiber shortens to length *AE*. Since the stimulation is not maintained, all parts quickly return to their resting states.

3, A repetitive (tetanic) contraction. Contractile element shortens maximally to length *AD*, as shown in *2*; since the stimulation is maintained, the elastic component has time to recoil to its resting length (*DF* = *BC*); the muscle fiber now shortens to length *AF*, a much greater contraction than that shown in *2*.

R, Typical contraction recordings of muscle corresponding to *1* (the resting state), *2* (a single twitch), and *3* (a tetanic contraction).

S, Typical stimulating impulse recording. Each deflection indicates one adequate stimulus.

A simplified explanation is that the fibrils are attached to the ends of the cell via elastic elements, so that before the call can achieve maximal shortening the slack in the elastic elements must be taken up. Since the time required for this shortening is longer than the duration of the active state of actomyosin folding, the full potential for shortening is not realized unless the active state is maintained by repetitive stimulation.[13] This condition prevails under normal conditions in which there is sustained rather than twitchlike muscular activity. Sustained contraction (called *tetanic* contraction) is produced by a train of impulses coming along the motor nerve; it produces shortening of the fiber which may be two to three times as great as the single twitch, and thus it is far more efficient[14] (Fig. 6).

A muscle is composed of many hundreds of muscle fibers, but its behavior mirrors that of its individual components. The individual fibers within the muscle are organized by the motor nerve fibers into groups called *motor units*. A motor unit consists of a single motor nerve fiber and all of the muscle fibers which it innervates. The motor nerve fiber, by profuse branching of its axon, may make connection with as many as 100 muscle fibers.[15] When this nerve fiber is activated, all the muscle fibers in that motor unit contract in unison. This, then, is the physiologic unit of muscular activity.[16]

Two types of contraction may be distinguished. In contracting, a muscle may bring two parts closer together; thus, it shortens in length. This is called *isotonic* contraction, since the tension within the muscle remains constant, and it is important in producing movement. On the other hand, in order to hold two parts in a stationary position a muscle may have to contract because of some outside force acting to cause the parts to move. This type of contraction, called *isometric* because the muscle length does not change, is important in the maintenance of posture against the force of gravity, which tends to collapse the joints.[17]

Nerve.—The basic unit of nervous tissue is the nerve cell or neuron, which consists of a cell body (cyton) and one or more processes (axon, dendrites) which may vary in length from fractions of a millimeter to several feet. The processes are composed of filaments (neurofibrils) surrounded by a membrane which is polarized much like the muscle fiber.[18] Excitation usually takes place at one of the special sites on the cell where the endings of other nerve fibers make contact (synapses). The stimulus comes from one or more of the connecting (presynaptic) nerve fibers. The events are essentially the same as those described for muscle; that is, with excitation there is partial followed by complete depolarization spreading over the entire fiber to its terminals, which in a motor nerve are in contact with the motor end plates of muscle fibers.[19] There is, however, one very important difference. A muscle fiber receives connection from only one nerve fiber, and when the nerve fiber is stimulated the muscle fiber almost always contracts. On the other hand, a nerve fiber usually receives connections from several different nerve fibers, and usually there must be simultaneous activation from more than one source in order for it to become stimulated. This process of two or more fibers acting to stimulate a third is known as *spatial summation*[20] and it, more than any other factor, gives the nervous system its versatility of response. If excitation at the synapse were obligatory, as it is at neuromuscular junctions, reflex activity would be stereotyped and incapable of modification. As it is, certain responses will be made if two or more circumstances coexist; if such coexisting conditions are not present, different responses will be seen.

Receptor.—One other important kind of nervous tissue is the receptor. Just as muscles are specialized to contract and nerves to conduct, receptors are specialized to become stimulated by various forms of energy and to transmit this excitation to the nerve fibers to which they are connected. There are many types of receptors, each specialized to respond to a certain kind of stimulus. One type of importance to the orthodontist is that which responds

to distortion; this is known as a ***stretch receptor*** or ***proprioceptor*** and is found chiefly in muscles, tendons, ligaments, and the periodontal membranes. The size and shape of this structure varies considerably, depending on its location.[21] Like muscle and nerve, it has a polarized membrane which becomes partially depolarized when the cell is distorted. This depolarization spreads to the connecting nerve fiber and excites it.[22] The receptor makes connection with a sensory nerve which carries the excitation into the central nervous system. This sensory nerve may synapse with the previously described motor nerve going to the muscle, and thus we have a simple functioning *reflex arc* consisting of a receptor, a sensory neuron, a motor neuron, and an effector (muscle fiber). Such a simple type of reflex arc actually exists in the living body and, as will be discussed later, is of fundamental importance in the maintenance of posture.

Reflex Activity.—Muscle is generally involved in performing one of two functions. Either it produces movement, in which case its function is said to be phasic and its contraction *isotonic*, or it maintains a position, and its function is said to be static in nature and its contraction *isometric*. All normal muscular activity involves reflex mechanisms. A reflex may be defined as a stimulus–response activity which is automatic and does not involve voluntary or thought processes. Reflex activity is largely self-regulatory, operating on the feed-back principle. In other words, some stimulus produces an action which, in turn, acts to decrease the stimulus or its effect. This is a very efficient and purposeful type of mechanism whereby lower levels of the central nervous system may control functions which satisfy basic needs, leaving higher levels of the brain free to subserve behavior of the more optional kind. If reflexes were incapable of modification, behavior would be dictated completely by environmental conditions, but this is not the case. All reflex activity operates under controls coming from higher parts of the central nervous system, each higher echelon adding finer regulatory measures.[23]

The nervous system performs these functions by two mechanisms which act similarly but produce opposite effects. These are the processes of ***facilitation*** and ***inhibition***. Facilitation, as the term itself implies, means making the reflex response more easily produced or making it greater or more evident, without increasing the external stimulus. On the other hand, inhibition means reducing or completely preventing the response, again without changing the external stimulus. Inhibition may be produced either by a decrease in the activity of facilitating mechanisms or by an active inhibitory process.[24] Intimate details of these processes are not completely understood, but the simplified explanation that follows may help us understand them.

In a reflex arc the motor neuron is activated by the sensory neuron which transmits excitation to it. However, a neuron usually requires simultaneous excitation coming from two or more sources; hence, the motor neuron requires summation of excitation in order to become stimulated. Actually, all motor neurons receive connections from several other neurons. Some of these are sensory, carrying impulses from peripheral receptors; others are descending from brain levels and are continually bombarding the motor neurons with

nerve impulses, of which some are excitatory and some are inhibitory. Thus, the ability of the peripheral sensory neuron to activate the reflex depends upon the excitatory state of the motor neuron which is, in turn, dictated by the relative balance existing between excitatory and inhibitory influences coming from the brain. In this way the brain continuously modulates reflex activity (Fig. 7).

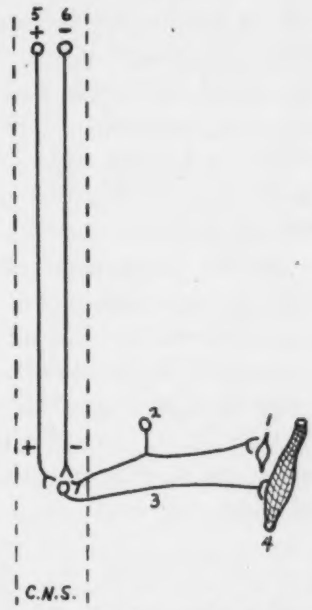

Fig. 7.—Schematic representation of a simple reflex arc showing facilitation and inhibition by higher centers. *1*, Stretch receptor (muscle spindle); *2*, afferent (sensory) neuron; *3*, efferent (motor) neuron; *4*, muscle fiber; *5*, descending neuron carrying facilitatory impulses from higher level; *6*, inhibitory neuron from higher level. Neurons *5* and *6* control the reflex act by changing the excitability of the motor neuron *(3)*.

Excitatory influences come mainly from the level of the midbrain and below; inhibitory impulses arise chiefly from the levels of the midbrain and forebrain. Although some inhibitory impulses actually descend to the lower motor neurons, most of them act to inhibit the excitatory brain areas.

In the maintenance of posture, the mandibular muscles must support the weight of the mandible as it hangs suspended from the cranium. Especially involved are the mandibular elevators which become stretched between their attachments as a result of the action of gravity upon the mandible. This distorts the stretch receptors within the muscle spindles and activates a reflex, causing contraction of these same muscles and thus relieving the stretch stimulus. This type of reflex, first described by Liddell and Sherrington[25] in 1924, is known as the *stretch* or *myotatic* reflex and is particularly well developed in all postural muscles. It is the very basis of all postural mechanisms and is also responsible for muscle tone, that state of partial contraction which all living muscles always exhibit (although in varying degrees). This reflex determines the postural position of the mandible which has been called the "physiologic rest position" and determines the intermaxillary distance at rest. The fact that the rest position has been found to be relatively stable for the

individual when repeated determinations were made[26] has been erroneously interpreted by some to mean that it is constant throughout life and in all body states. If that were true, this group of muscles would be unique, for all other aspects of the body's posture are subject to modification by fatigue, age, tension, fear, anxiety, and other physical and emotional states. A person's postural muscle tone is obviously not the same in the morning when he is alert and well rested as it is at the end of a day of hard work. It is certainly not the same during sleep as it is during the waking state; nor is it the same in youth as in old age. Muscle tone and postural positions will vary, depending upon the relative balance of excitatory and inhibitory impulses going from the brain to the lower motor neurons. Sherrington[16] has called the state of this balance the *central excitatory state.* Recent evidence indicates that the muscle stretch receptors themselves receive motor innervations which may alter their response to distortion.[27]

Thus, we must realize that the physiologic rest position is not rigidly fixed. Yet, in a practical sense, we may speak of a vertical or intermaxillary dimension which is a "biologic constant" exhibiting a rather narrow range of variation, and, if standard conditions for determining it are defined, its measurement may be quite reproducible. In this sense, the intermaxillary distance at physiologic rest is "constant," just as the basal metabolic rate is constant. In making the latter measurement, you will recall, certain very definite standard conditions of body state must be defined.

DISCUSSION

These considerations explain the caution with which we treat cases of close-bite (Figs. 2 and 3). We are all aware of the unpredictable prognosis of such cases, and yet we know that in some cases a great deal of the bite opening achieved during treatment is retained. Whitman[28] feels that the key to the solution lies in reducing the inciso-incisal angle by lingual root movement of the incisors. To this one may add that, physiologically, it seems more sensible to level the occlusal table by depression of anterior segments rather than by elevation of posterior segments, since the latter procedure encroaches upon the interocclusal space and is more likely to upset the muscular balance.[1]

Movements of the mandible can be produced in experimental animals by direct stimulation of mandibular muscles or their motor nerves, but these do not resemble functional movements. Such movements are produced only by stimulation of higher centers of the brain. Physiologically, they are produced by well-integrated reflex actions involving all of the muscles in the orofacial area. For example, in a simple, relatively weak movement, such as that involved in depression of the mandible, certain muscles (the external pterygoids and the suprahyoid group, bilaterally) must contract together, others (the masseter, internal pterygoid, and temporalis muscles, bilaterally) must relax reciprocally, and still others (for example, the infrahyoid group, bilaterally) must maintain an isometric contraction. Even this does not describe the entire

picture, however, for muscles of the posterior cervical group and other groups are also active. These activities are regulated by two kinds of mechanism which physiologists call *reciprocal* and *identical innervation.* As the terms imply, reciprocal innervation refers to the reciprocal activity which occurs in antagonistic muscle groups, while identical innervation describes the co-contraction of muscles that normally act in unison.[18]

Like walking, mastication is voluntarily initiated but is regulated reflexly and does not require thought or concentration. Like walking, mastication is a learned activity. At birth the infant has a sucking–swallowing reflex; later he learns to interpose mastication before swallowing.[29] Just how this occurs is obscure, but it may be associated with stimulation of oral sensory receptors by solid foods together with a gag reflex which returns larger particles to the oral cavity when attempts are made to pass them through the faucial pillars. Mastication, like walking, requires smooth reciprocal action of antagonists and correlated action of synergists. This is made possible by reciprocal innervation which reflexively inhibits antagonists when one group of muscles is contracting and by identical innervation which reflexly coordinates cocontraction of synergists. When these mechanisms fail, smooth action is impossible and trismus, subluxation, or mandibular displacement may result.

During mastication the muscular action is continuously adjusted according to the resistance of the bolus and other factors which stimulate proprioceptors in the periodontal membranes and exteroceptors in the oral soft tissues. This prevents harmful or traumatic forces from reaching the teeth.[30] An excellent example of this protective mechanism is seen in the immediate inhibition of mandibular elevators and the reflex jaw opening which results when the tongue or cheek is inadvertently bitten or when a hard object is suddenly encountered in food that is being chewed.

The processes responsible for producing precise jaw positioning during closure so that the teeth are engaged in maximum and comfortable intercuspation are integrated in the brain. These involve interaction of thalamus, pons, cerebrum, and cerebellum and are similar to the mechanisms by which the individual remains constantly aware of the relative positions of different parts of the body. For example, such processes make it possible for one to bring the tip of a finger to the tip of the nose without the aid of vision.[31] The proprioceptors of muscles are themselves capable of producing quite accurate repositioning of body parts, but the masticatory system has, in addition, other receptors within the periodontal membranes of the teeth which may effect even more precise movements. These are the receptors which ensure that the dental arches will be brought together in one position, that of maximum occlusal contact, which produces a minimum of trauma, discomfort, and pain. In normal occlusion this position is, by definition, the centric occlusal position.

However, certain disharmonies or aberrations of occlusion are capable of deflecting the mandible into eccentric positions, and it is these same mechanisms which are responsible for a shift in jaw-closing position (so-called "acquired" or "false" centric) when occlusal prematurity develops as a result of faulty

restorative procedures or aberrant tooth positions. The pattern of closure is reflexly modified to accommodate to the new situation in order to prevent pain or injury to tissues. Such alterations will persist as long as the stimulating agent is present, but the closing position will usually revert to the former pattern when the precipitating factor is removed. When such conditions persist for many years into late adult life, however, the recovery may be neither spontaneous nor complete. The "memory" of this system may cause the mandibular displacement to persist for a time even after the cause has been removed. Moreover, when such a condition has produced adaptive changes in tissues, the degree of recovery will depend on the physiologic reversibility of the processes within these tissues. Generally speaking, the older the physiologic age of the tissues, the less reversible these changes may be. Treatment of such conditions may be more successful if muscle-retraining procedures are added.

These considerations explain why the experienced orthodontist will always examine the occlusal relationships when jaw closure is stopped just short of occlusal contact as well as in the position of functional centric occlusion.[32] If the malocclusion includes a factor that is producing a mandibular eccentricity, this may be completely obscured if the patient is told to "bite" or "close" and only the interdigitation of teeth is examined. When the patient occludes the teeth, the reflex mechanisms may ensure the attainment of a position of maximum occlusal contact in comfort, even at the expense of producing mandibular deflection.

Thus, the aim of early treatment in cases of anterior and posterior crossbites and other problems presenting occlusal interferences is to prevent longstanding mandibular eccentricities, especially during developmental periods when such deviations may produce adaptive changes. Here the distinction between growth and development should be emphasized. Many authors have rightfully pointed out that there is no proof that muscles can influence growth, but there is evidence that muscular activity may influence skeletal development.[33]

When such malocclusions are corrected early, new reflex pathways are activated and the patient can quickly adapt to them. The period of transition from deciduous to adult dentition is characterized by constantly changing occlusal sensory stimulation. Thus, the organism is probably better equipped physiologically to adapt to such changes at this time. This may explain why, as a rule, young patients respond better than mature adults to orthodontic treatment. The latter are more likely to develop temporomandibular joint symptoms, such as clicking, subluxation, muscle spasm, and pain, which may be manifestations of muscular incoordination produced by the patient's failure to adapt to the altered occlusal sensations. Temporomandibular joint clicking has often been described in orthodontic patients following institution of intermaxillary elastic traction. Fortunately, in most instances this clicking is transitory in nature and is not complicated by other joint symptoms. The fact that such problems are not more numerous, in view of the marked proprioceptive changes produced during orthodontic treatment, is ample evidence of the remarkable adaptability of this system.

The how, when, and why of muscle retraining require additional investigation. Certain principles seem clear. If the problem is one of atony, exercises which promote use of the muscles, preferably against resistance, are of value. These should be instituted when the deficiency is noted. On the other hand, if the problem is one of dysfunction (for example, tongue-thrust in swallowing), a certain degree of tooth repositioning may be necessary in order to provide the sensory stimulation necessary for the establishment of proper reflexes. It should be remembered that one of the functions of the tongue in swallowing is to prevent anterior displacement of the bolus. To this end, the tongue will naturally tend to fill the space between upper and lower incisors in an anterior open-bite.

Fig. 8.—A case of anterior open-bite corrected by myofunctional therapy without mechanical intervention.

In such cases proper tongue function may be more easily established after mechanotherapy has reduced the open-bite. Even in these cases, however, training is best begun early, since any improvement so obtained will facilitate mechanotherapy and in some cases even obviate it (Fig. 8).

The actual techniques to be used in muscle retraining are still largely empirical. Of late, however, workers in the fields of physical medicine and rehabilitation have been applying techniques of stretch and controlled manual resistance together with rhythmic alternate activity of agonist and antagonist muscle groups of the limbs and trunk in an attempt to produce proprioceptive neuromuscular facilitation.[34-36] These methods, which have been applied to the diagnosis and management of temporomandibular joint disorders,[37] should prove valuable if extended into the field of orthodontics.

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PRECEPTORSHIPS

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The associateship (preceptorship) training program of the American Association of Orthodontists, promulgated as an adjunct to the new eligibility requirements for active membership adopted by the Association in 1957 and currently being administered by the several constituent societies, has been a controversial subject, and there has been much confusion concerning many aspects of it in the minds of members.

It is not my purpose in this article to delineate in detail the actions which led to the adoption of the current program of associateship training. There are, however, certain controversial questions which should be discussed in order that the associateship training program might be placed in proper perspective. It is hoped that this discussion will be construed as an effort to report objectively what has occurred as it relates to the program and not as an argument for or against the program per se.

1. *Was it necessary, wise, or expedient to consider the matter of eligibility requirements further after the adoption of the so-called 1,500 hour amendment at San Francisco in 1955?*

In order to understand the various actions taken by the Association relative to eligibility requirements between 1954 and the present, it is necessary to have some concept of the development of orthodontic education (other than undergraduate) prior to 1954 and also to appreciate the significant parallel to this development of the eligibility requirements for membership in the American Association of Orthodontists.

Historically, from the days of Pierre Fauchard early in the eighteenth century to the time of Edward H. Angle at the start of the twentieth century, an extensive literature relating to orthodontics had developed. Much of this literature foreshadowed current orthodontic thought.

There appears to be no record of any effort to establish orthodontic training above the undergraduate level during this period. However, the necessity of adequate training was recognized by Joseph Murphy, who stated in 1811: "It is now pretty generally known that children's teeth may be regulated in their growth, so as to prevent irregularities; but it is of the greatest importance that the regularity of children's teeth may be entrusted to proper and skillful hands; incurable deformities and loss of teeth are too often the consequence of improper treatment."[1]

Presented before the Northeastern Society of Orthodontists, Boston, Massachusetts, Nov. 14, 1960.

At the turn of the century Edward H. Angle expressed the opinion, based upon his experience in teaching orthodontics in dental colleges, that the proper training of the orthodontist could not be accomplished at the undergraduate level. After unsuccessful efforts to interest two universities in the establishment of special departments of orthodontics, Angle established the Angle School of Orthodontia.[1] For over a decade the Angle School offered the only formal training in orthodontics. Gradually other short courses, not affiliated with a dental school or university, came into being.

The first university course was inaugurated about 1918, and between 1918 and 1933 eleven university courses were established. By 1955 there were twenty-two such courses. In an effort to determine the impact which the establishment of formal graduate courses had on orthodontic training, the 1934 and 1954 editions of the *Orthodontic Directory of the World*[2, 3] were surveyed. Of the approximately 900 United States orthodontists listed in the 1934 *Directory,* only 12 per cent had had any type of university-affiliated training. By 1954, of the approximately 2,000 United States orthodontists listed, nearly 50 per cent had been trained in university-affiliated schools.

As orthodontic training evolved slowly over the years, so did the eligibility requirements for membership in the American Association of Orthodontists. At first the only requirement was an interest in orthodontics, then the candidate was required to devote a designated proportion of his practice to orthodontics. Later a short period of complete specialization and then longer and longer periods of complete specialization were required.

By 1954 the eligibility requirements for active membership called for three years of specialization, including one year of full-time university graduate or postgraduate orthodontic training; three years of specialization, including a two-year preceptorship or an equivalent which must satisfy the committee that passed on applications; or four years of specialization, including informal training by preceptors, suitable short courses, or seminars which satisfied the committee that passed on applications.[4]

Additional requirements were that the applicant be a member in good standing of his local, state, and national dental organizations and that he be endorsed by two active members; these provisions are still in effect.

There had also been developed at the constituent society level a probational membership called associate membership. By 1954 this class of membership was limited to persons in the exclusive practice of orthodontics, and minimum standards of eligibility for this class of membership had been established in the bylaws of the American Association of Orthodontists.

Since nearly 50 per cent of the practicing orthodontists (and probably an equal percentage of the members of the American Association of Orthodontists) had received some sort of university-affiliated training, and since the eligibility requirements for active membership in the Association were difficult to interpret, and thus lacked exactness as criteria for assessing adequacy of training, the time seemed favorable for establishing higher standards of eligibility for admission to active membership.

The so-called 1,500 hour amendment, which was introduced at Chicago in 1954 and adopted at San Francisco in 1955, represented an effort in that direction. The amendment provided that the then existing eligibility requirements be eliminated and replaced by a requirement that each candidate must have been in the exclusive practice of orthodontics for three years and must have successfully completed an orthodontic course of a minimum of 1,500 hours in an approved dental school.

In the debate which preceded its adoption, many valid arguments were presented for and against the amendment. However, although the most compelling reason why the amendment would not solve the Association's problem was mentioned, it was never really debated. If the object of the Association as stated in its constitution had been accomplished by raising the standards of eligibility for admission, which the adoption of this amendment certainly did, there would have been no need to consider further the question of eligibility for membership. However, if the object of the Association is construed to be the advancement of the science and art of orthodontics generally, then it was fortunate indeed that at this same session authority was granted to give further consideration to the matter of eligibility to membership, which ultimately resulted in the adoption of the current eligibility requirements. It should be pointed out that, by its action in New Orleans, the Association has raised the standards of eligibility over those existing prior to 1957. Further more, since that time no members have been admitted who would not have been admitted under the grandfather clause had the 1955 amendment remained in effect.

2. *What was the reason for the so-called grandfather clause adopted at New Orleans in 1957? And what effect did adoption of this clause have?*

This clause authorized all constituent and/or component societies to continue processing applications under previously existing eligibility requirements up to and including the time of their next meeting.

This clause was adopted to provide an avenue of transition between the old bylaws and those adopted at New Orleans in 1957. The effect was to allow all pending applications to be acted on under the old bylaws up to and including the time of the next meeting and, further, to allow associate members to be advanced to active membership under the eligibility requirements in effect when they were accepted into associate membership.[5]

Three years have now elapsed, and unless there are unforseen extraordinary circumstances there should be no further need of this provision.

Full details of the various actions of the Association with regard to changes in eligibility requirements have been reported in the AMERICAN JOURNAL OF ORTHODONTICS from 1954 to 1960.[6-13]

3. *Is the associateship (preceptorship) program a substitute for university training in orthodontics?* The answer is simple: an emphatic "No!" It is unfortunate that this connotation has been placed on preceptorship training; it is even more unfortunate that it has been publicized. Associateship (preceptorship) training is a method of training under controlled conditions acceptable to

the American Association of Orthodontists as a requirement for admission. It is competitive only with those methods of training that are unacceptable as requirements for admission to the Association.

In the brief outline of the development of orthodontic training given earlier in this article, it was impossible to interweave the significant parts played by preceptor-trained men. To the earnest student of the development of orthodontics, the contributions of these men as authors, clinicians, and teachers are well known.

In an address to the Golden Anniversary Group in New Orleans in 1957, our own Jo Eby,[14] who has been a keen observer of the orthodontic scene for many years, paid tribute to the contributions of preceptorships and suggested their continuing usefulness when he said:

> In addressing this august body on the general subject of achievements, it would be remiss on my part not to include the long-established tradition of preceptorships.
>
> Preceptorships have been the bone and fiber and a vital lifeline throughout the records and history of orthodontics and this seems destined to remain so indefinitely. This form of training has been recognized as an established institution in all of the professional cultures since the days of antiquity. It is the priceless transmission of knowledge, experience, and their practical application proffered as a capital investment from masters of experience.
>
> Preceptorships, so long established, include many phases of mutual benefits shared alike by donor and recipient and possess an infinite range of variation which cannot be acquired in any other way. A young man, regardless of his aptitude or preparation, when embarking alone upon his career can only be exposed to the pitfalls of his experience and must learn the hard way. A complete analysis of all the benefits of preceptorships to young men would be a volume within itself and would only reflect the mirror image of the possibilities of their expanding qualifications and the caliber of their future achievements.

In the same address, Dr. Eby also said:

> It seems a natural expedient for the graduate or postgraduate to prefer a period of perhaps not longer than five years in the office of a qualified member of the American Association of Orthodontists, rather than to utilize such academic training of whatever nature he has gained to start out alone. After all, sixteen months under the best academic facilities is not very long, and the results become entirely dependent upon the nature of the courses which have been offered by the professor in charge and his staff. One thing certain is that a preceptorship means a golden opportunity to any young man who aspires to dig out the rudiments of experience by means of actual practice under an older orthodontist!

The validity of Dr. Eby's observations is borne out by the fact that a survey of the 1960 *Orthodontic Directory of the World*,[15] listing nearly 3,000 orthodontists practicing in the United States, indicates that some 850 have been in the past or are currently engaged in some sort of associateship with another orthodontist. Of this group, some 350 have had formal graduate training but have, nevertheless, seen fit to enter into associations with other orthodontists.

In this survey of the 1960 *Orthodontic Directory of the World* the data shown in Table I were developed, showing in a general way the training of orthodontists in the various categories.

The attempt has been made to place the associateship training program in proper perspective by discussing the evolution of specialty training in orthodontics, some of the controversial and misunderstood aspects of the development

TABLE I

	ACTIVE MEMBERS OF A. A. O.		ASSOCIATE MEMBERS OF A. A. O.		NONMEMBERS OF A. A. O.	
	UNIVERSITY TRAINED	NOT UNIVERSITY TRAINED	UNIVERSITY TRAINED	NOT UNIVERSITY TRAINED	UNIVERSITY TRAINED	NOT UNIVERSITY TRAINED
Spot check of first 587 orthodontists in 1960 *Directory*	292	118	101	14	43	19
Northeastern Area (917 orthodontists)						
Other states	13	12	3			
Canada	11	8	10		8	1
New York	227	143	63	6	132	52
Connecticut	25	8	12	2	12	7
Maine	5	3				2
Massachusetts	56	28	12		2	9
New Hampshire	1	1			26	1
Vermont	2					1
Rhode Island	6	5	1	1		
	346	208	101	9	180	73

Total university-trained A. A. O. members, active and associate, in Northeastern area	447
Total non-university-trained members, active and associate, in Northeastern area	217

of associateship training, and the part played by associateships or preceptorships in orthodontics.

Immediately after the 1957 meeting of the American Association of Orthodontists, the constituent societies started to set up machinery for the administration of the program. By 1958 most of the societies had developed somewhat individual outlines of the manner in which they believed the program should be carried out in their respective organizations. These outlines were based on the provisions in the bylaws regarding eligibility for active membership adopted in 1957 and amended at subsequent sessions and on the Admissions Committee's resolutions which were adopted in 1957 and 1958. The constituent societies had also provided for committees to direct the program. Several of the constituent societies have published their regulations governing the program in the AMERICAN JOURNAL OF ORTHODONTICS.[16-18]

At the 1959 session in Detroit President Martinek called an informal meeting of representatives of the Qualifying Committees of the several constituent societies for the purpose of discussing their mutual programs.

Early in his administration President Anderson appointed a Qualifying Committee at the American Association of Orthodontists level consisting of the chairmen of the Qualifying Committees of the constituent societies. This committee, under the chairmanship of J. Lyndon Carman, met in Washington, prior to the A. A. O. meeting of 1960 and developed a master outline which was subsequently approved by the Board of Directors of the American Association of Orthodontists.

This master outline allows some flexibility at the constituent level, particularly in relation to reports and examinations. The outline, as currently used in the Northeastern Society of Orthodontists, is as follows:

AMERICAN ASSOCIATION OF ORTHODONTISTS
MEMBERSHIP REQUIREMENTS

In conformity with the membership requirements of the American Association of Orthodontists as outlined in Chapter I and in Chapter XIV of the Constitution and Bylaws, the American Association of Orthodontists has set forth the following requirements. These apply primarily to the associateship (preceptorship) training program, but Item III applies to all applicants. In addition, the Northeastern Society of Orthodontists has passed certain resolutions which have been incorporated as part of these requirements.

I. *Senior Associate or Preceptor*

A. The senior associate must be an active member of the A. A. O., which membership shall have been continuous for the previous eight years, and he must have been approved by the Qualifying or similar committee to act as senior associate or preceptor.

B. The senior associate must be conducting a full-time practice.

C. The senior associate must notify the chairman of the Qualifying Committee of the A. A. O. and the chairman of the Qualifying Committee of the Northeastern Society of Orthodontists of inception, completion, or termination of the association with the junior associate within thirty days of said inception, completion, or termination.

1. The senior associate shall make formal application to the Qualifying Committee through the secretary-treasurer of the Northeastern Society of Orthodontists for the privilege of accepting each junior associate or student for training.
2. Upon receipt of this application, a standard questionnaire shall be sent to the senior associate. The questionnaire will be the same for all applicants, and the questions listed shall be such as to give the Committee the basic information it requires in determining the qualification of the senior associate to act in that capacity. This questionnaire is not final, nor does it preclude the Committee from using other methods of seeking information.
3. Immediately following mutual agreement by the Qualifying Committee and the parties to the associateship (preceptorship), the associateship shall be approved and the parties so notified in writing. All communications relative to the establishment of associateship (preceptorship) training programs shall remain confidential.
4. Should the Committee refuse the applicant, the said applicant has the privilege of appealing to the Board of Directors, whose decision shall be final.
5. The senior associate shall be allowed to train only one preceptee (junior associate) at a time.
6. The senior associate shall file with the Qualifying Committee a detailed outline of the course of instructions he proposes to give the student. This outline shall be attached to the application.

II. *Junior Associate or Preceptee*

A. The junior associate shall make formal application to the Qualifying Committee of the A. A. O. and the Qualifying Committee of the Northeastern Society of Orthodontists for permission to become a student of the senior associate of his choice. Should the Qualifying Committee deny the student's application, he shall have the right to appeal to the Membership Committee. Should they deny his appeal, he may then appeal to the Board of Directors, whose decision will be final.

B. A standard questionnaire shall be filed with the Qualifying Committee of the Northeastern Society of Orthodontists by the junior associate (preceptee).

C. After being approved by the Committee, the junior associate shall spend full time in the exclusive practice of orthodontics in the office of the senior associate.

D. The clinical and laboratory work of the junior associate shall be open for inspection by the Committee at any and all times.

E. At the end of both his first and second years the junior associate shall submit written progress reports of his clinical and laboratory work to the Qualifying Committee. The Qualifying Committee may demand, at its discretion, a written or oral examination and presentation of case reports and the presentation of a thesis. At the end of the second year the student shall be prepared to take an examination in the theory of orthodontics given by this same Committee. A report of the student's progress shall be sent by the Qualifying Committee to the secretary of the local constituent society at the end of both the first and second years. The Committee shall inform the senior associate of the progress made by the junior associate at these times. Should the Committee, after reviewing the report and outline, feel it necessary, they may ask the senior and junior associates to meet with the Committee at the time of the next meeting of the Northeastern Society of Orthodontists to discuss the program and make recommendations relative to it.

F. The junior associate upon completion of eighteen months of approved preliminary training, shall be eligible for associate membership in the constituent society of the A.A.O. under whose jurisdiction he is being trained. No application for associate membership of a junior associate at the conclusion of eighteen months' training, as provided in the American Association of Orthodontists' bylaws, shall be considered for such associate membership in this Society without prior approval of the first year's associateship by the Qualifying Committee.

G. At the end of the third year the student shall present evidence of his clinical ability to the Qualifying Committee of the constituent society and shall be examined by the Committee and/or the Board of Censors as to his general knowledge of the science of orthodontics. The Qualifying Committee may demand, at its discretion, a written or oral examination, the presentation of case reports, and the presentation of a thesis.

H. The junior associate shall be expected to take at least two of the short courses offered by the dental colleges or by a recognized orthodontic educator. Membership in a recognized study group will be acceptable in lieu of the above.

I. No clinical work shall be performed by the junior associate without the personal supervision of the senior associate except while the senior associate is on vacation or is ill.

J. Upon successful completion of this program, the junior associate shall be recommended to the Board of Censors of this Society for active membership subject to the completion of eligibility requirements. No application for active membership shall be considered for such membership without prior approval of the complete program by the Qualifying Committee.

K. Should either the junior associate or the senior associate become dissatisfied with their association, either or both shall have the privilege of presenting his case to the Qualifying Committee.

L. A preceptee shall be, at all times, in the exclusive practice of orthodontics.

III. *All Applicants for Membership—College- or Associate-Trained.* In evaluating the qualifications for membership of any applicant, the Qualifying Committee of each constituent society shall satisfy itself that the applicant possesses the necessary knowledge, both mechanical and biologic, to render competent orthodontic services.

(*Note:* The above rules and regulations were made necessary by the changes in the Constitution and Bylaws of the American Association of Orthodontists as passed in May, 1957, at the annual meeting in New Orleans. These were to become effective May 16, 1957. However, since there are a few instances where candidates had started under the previous rules and would have been unfortunate victims of these changes, these persons will be given special consideration by the Qualifying Committee in order that they may continue to active membership status.)

STUDY REQUIREMENTS FOR PRECEPTORSHIP TRAINING

Upon notification of a proposed associateship (preceptorship), the Qualifying Committee shall supply the senior associate and the junior associate with an outline, in writing, of the recommended program of study. There shall be a minimum requirement of study for preceptorship training as adopted by the American Association of Orthodontists:

I. A. A complete and thorough study of at least two standard orthodontic textbooks in latest editions
   1. *Applied Orthodontics* by McCoy and Shepard
   2. *Practical Orthodontics* by G. M. Anderson
   3. *Orthodontics: Principle and Prevention* by J. A. Salzmann
      Orthodontics: Practice and Technics by J. A. Salzmann
   4. *Textbook of Orthodontia* by H. W. Strang and W. M. Thompson

   B. *Bone and Bones* by Weinmann and Sicher

II. A thorough study of such articles from the AMERICAN JOURNAL OF ORTHODONTICS as the Qualifying Committee may designate.
   A. *The Panel Discussion* by Hahn, Tweed, Hellman, Grieve and Brodie, AM. J. ORTHODONTICS **30**: 401-460, 1944.
   B. Waugh, L. M.: The American Association of Orthodontists, AM. J. ORTHODONTICS **38**: 75-129, 1952.

III. A thorough study of at least ten articles written before the preceptorship was begun, to be selected by the senior associate. These articles may be from any scientific journal. They should reflect knowledge that will be useful to orient the junior associate in his thinking about the appliance therapy and/or treatment philosophy that he will study with the senior associate. A list of articles selected should be submitted to the chairman of the Qualifying Committee.

IV. A careful reading of all articles published in the AMERICAN JOURNAL OF ORTHODONTICS during the preceptorship term.

V. Thorough training in the construction and manipulation of the appliance of choice and instruction in at least two other appliance therapies.

VI. Regular discussion periods each week between the senior and junior associates relative to diagnosis and treatment of cases presently under treatment.

VII. Before the junior associate is elected to membership, he shall have taken at least two university-sponsored short courses in subjects related to orthodontics (if such courses are available). (Section II, Junor Associate, H.)

VIII. The Qualifying Committee shall in no case insist upon instruction in any certain type of appliance or method of treatment but shall put emphasis upon general orthodontic knowledge.

IX. No revision shall be allowed which is less than the minimum requirements previously outlined.

X. At the end of three years of associateship training both senior and junior associate shall affirm, in writing, that the training outlined, or as amended, has been followed, listing articles and textbooks studied and explaining any deviations that may have been necessary.

Additional texts may be utilized as collateral reading, or a study may be made of articles or books on the following subjects:

A. Facial growth
B. Cephalometrics
C. Tooth measurements
D. Basal bone versus tooth anatomy

E. Indications and contraindications for extraction
F. Treatment analysis and diagnosis
G. Extraoral anchorage
H. Retention
I. Relapses
J. Bone
K. Muscle
L. Metallurgy

The master outline adopted in Washington states that a bibliography on the suggested subjects will be furnished by each Qualifying Committee.

In the Northeastern program both senior and junior associates are supplied with a list of articles and books for collateral reading. This list, thirty-six pages long, covers the areas suggested by the Admissions Committee in their 1958 resolutions and suggests sixteen other areas for reading and study, such as anatomy, histology, embryology, cleft palate, histopathology, etc. Currently, this reading guide is being used by a number of the other constituent societies.

The questionnaires utilized by the Qualifying Committee in assessing the qualifications of the senior and junior associates are basically those first developed by the Pacific Coast Society. The senior questionnaire has fifty-six questions. If they are all answered, the Committee should have a fairly comprehensive idea of the senior associate's background and method of practice. The junior questionnaire has fourteen questions. Here the effort is to determine the Applicant's scholastic background, his motivation for studying orthodontics, his professional background, and whether he has applied for graduate study.

The American Association of Orthodontists has developed a controlled program of associateship (preceptorship) training which, within the limitations imposed by this type of training, can undoubtedly produce a far more effectively trained orthodontist than uncontrolled preceptorships or combinations of short courses.

4. *What are the limitations of associateship training?*

Obviously, the most important are those imposed by the relative qualifications of the parties involved. If the senior associate is conducting a well-regulated orthodontic practice, is conversant with modern orthodontic thought, and is inspired by a desire to do a creditable job in supervising the associateship, and if the junior associate possesses an excellent scholastic background, highly developed manipulative skills, and proper motivation, all other limitations fade into insignificance. The success of the associateship is directly proportional to the degree to which these qualifications are possessed.

As basic science study must be largely from collateral reading, the lack of adequate library facilities may impose a limitation. This may be overcome by interlibrary loans from a local library or loans from the library of the American Dental Association.

Another limitation in basic science study, and possibly also in collateral reading generally, might be lack of experience on the part of the senior associate in proper guidance in the organization of such material. Here the solution might lie in an appeal to a university-trained colleague or to the Qualifying Committee.

The lack of laboratory material in certain of the basic sciences, particularly histopathology, may prove to be a limitation. This might be overcome by securing loan material or attending special courses given by schools or dental societies.

These comments suggest that some ingenuity may be required to overcome certain limitations inherent in such a program.

That the program is being seriously pursued is indicated by the following progress report from a junior associate:

> The first six months under my preceptorship were split between our laboratory and patients. My preceptor spent time demonstrating how to make Kesling diagnostic setups, how to design and make retainers and labial and lingual arches, and how to solder bands and attachments, bend ideal arches, and fit bands. I then constructed appliances on a typodont and spent many hours working it. I was then shown how to bend bands directly and how to form, place, and tie arches in patients' mouths.
>
> Time was spent discussing and diagnosing our cases with my preceptor. In the beginning, we were using mainly the edgewise technique, with labiolingual and twin-wire techniques as adjuncts. To help me, I took Dr. Robert H. W. Strang's edgewise course, given at Temple University in January, 1959. In October, 1959, I went to St. Louis University and took Dr. Joseph Johnson's twin-wire course. In November, 1959, I took a course in clinical cephalometry under Dr. Viken Sassouni at the University of Pennsylvania.
>
> In March of this year, my preceptor traveled to the offices of Drs. Kesling and Rocke, where he studied the Begg light wire technique under the leadership of Dr. P. R. Begg. From that time on, we have incorporated a great deal of these ideas into our technique and philosophy. To get further ideas on the light wire technique, I have applied and have been accepted for Loyola University's course in the light wire technique to be given in January, 1961, under the direction of Dr. J. J. Jarabak.
>
> The reading which I have done is on the following pages.

The reading list submitted contained seventy-four articles from the literature plus eleven texts, including two standard orthodontic texts. The material from the literature is concerned largely with the areas suggested in the program of study.

There have been very favorable reports from various sections of the country on the progress of the associateship training program. A fair assessment of its real effectiveness cannot be made until an appreciable number of junior associates or preceptees have been examined.

The following excerpt from a letter sent out to the junior associates who are nearing the end of their associateships indicates the type of examination currently being used in the Northeastern Society:

> The examination will probably be largely an oral examination covering both mechanical and biological areas. The candidates will be asked to present five case reports, two of which should be completed cases and three of which may be currently still under treatment at the time the case report was developed, but obviously should be sufficiently advanced in progress to give the Committee some indication of relative proficiency in treatment. One of the cases presented should have the appliances used in treatment mounted on models as part of the case presentation. All case presentations should include an outline of all data used for classification and differential diagnosis, such as models, x-rays, cephalograms (if used), photographs, the treatment plan, and may include progress models, photographs, cephalograms, etc.

5. *What is the future of the present program of associateship training?*

At the American Association of Orthodontists meeting in Detroit in 1959, an amendment to the eligibility requirements was introduced to eliminate associateship training as an eligibility provision for active membership, this amendment to take effect five years from the date of its enactment. A grandfather clause was appended to protect associateships registered before the annual meeting in 1965.[19]

At the 1959 meeting of the American Dental Association in New York the Council on Dental Education submitted "Requirements for National Certifying Board for Special Areas of Dental Practice." One of the provisions in this statement, under the heading "Certification Requirements," was that "until January 1, 1967, candidates entering the preceptorship program operated by the American Association of Orthodontists may have the study and training of such program accepted as a substitute for a formal education program." This was approved by the House of Delegates of the American Dental Association.[20]

At the American Association of Orthodontists meeting in Washington in 1960, the amendment introduced at Detroit was revised to conform to the statement of the Council on Education, namely, to become effective in 1967, and was adopted as revised.[21]

On the basis of the actions of the American Dental Association and the American Association of Orthodontists, it would seem that the current provision relative to the American Dental Association's acceptance of preceptorship training would cease to exist after Jan. 1, 1967, and that eligibility for active membership in the American Association of Orthodontists through preceptorship training would cease by 1970.

In the next few years that the associateship training program is to be in effect every effort should be made not only to maintain a high level of efficiency in its operation but to seek ways of improving it by amending the regulations in conformity with changing events.

Many proposals relating to specialization in general and to orthodontics in particular are being considered by the Council on Dental Education of the American Dental Association, and these may very materially affect the specialty. While there is a strong temptation to abandon this attempt at objective reporting, polish up the crystal ball, and philosophize on what may happen in the future, such prognostication hardly comes within the scope of this presentation.

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AGE AND SEX DIFFERENCES IN THE DENTOFACIAL CHANGES FOLLOWING ORTHODONTIC TREATMENT, AND THEIR SIGNIFICANCE IN TREATMENT PLANNING

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INTRODUCTION

A UNIQUE phenomenon is presented by the apparently infinite possibilities of variation in the human face: No two faces are alike. Among other forms of animal life at the final hierarchical classification level of species individuals are relatively indistinguishable from each other except by size, color, or surface markings. In man, however, each individual's face is different. Even siblings usually are so different in facial conformation as to present no problem in identification.

There are also generally recognized structural and proportional differences between young and mature faces and between male and female faces. The pattern of these variations is further complicated by sex linkage in timing of the change from a child's face to an adult's.

The orthodontist is concerned with these considerations for two dissimilar but related reasons: (1) He finds himself able to alter facial conformation to some considerable extent,[1, 2] and (2) he has devised appliance systems by which he can control normal, progressive facial alterations as a part of the routine treatment procedure in correction of abnormal or unpleasant facial contours.[3]

It has therefore become necessary to examine the mechanism and locus of facial changes through more and more refined differential growth studies. In the light of these studies, it has sometimes become expedient to re-evaluate some of the conclusions drawn from earlier works. Brodie's[4] monumental paper entitled "The Growth Pattern of the Human Head From the Third Month to the Eighth Year of Life" clearly demonstrated that "the morphogenetic pattern of the human head . . . once attained, does not change." It has been pointed out, however, that "constancy of pattern" can no longer be accepted as indicating a common straight-line growth pattern for all faces through the entire growth period.[5]

In 1951[6] I compared the facial and dental patterns of a group of thirty-one boys and thirty-one girls with those of the young adults appraised by Downs[7] in an earlier study. It was shown that the face of the 11- to 14-year-old child

This thesis, which was given as a partial fulfillment of the requirements for certification by the American Board of Orthodontics, is being published with the consent and the recommendation of the Board, but it should be understood that it does not necessarily represent or express the opinion of the Board.

with excellent occlusion did not present the same proportions as the face of the young adult. In general, the younger person had a more convex face, less upright incisors, and a more protrusive denture. Thus, the dentofacial pattern changes with maturation. It was also shown that during this age span the female facial pattern was significantly less convex (that is, it was more similar to the adult face) than the male facial pattern. Thus, the girl between 11 and 14 years of age was closer to having achieved an adult dentofacial relationship than the boy, and therefore she had less growth potential.

Certainly, then, age and sex are significant factors for the orthodontist to consider in formulating a treatment plan in which growth is to play an important part. If it can be shown that these changes in dentofacial relationship operate following orthodontic treatment, then age and sex are also significant in a treatment plan in which active treatment will be brought to a close before facial growth and proportional change have ceased. This problem will be explored in the present article.

REVIEW OF THE LITERATURE

It is difficult to review the literature on these variables in an organized fashion, since they sometimes have been attacked separately, sometimes together, and sometimes as part of another problem. In a great many papers, however, pieces of the pattern of differential facial growth and maturation and sex differences can be found.

Hellman,[8, 9] in 1927, specified that growth could not be considered solely as increase in size; it also included differentiation. He postulated seven stages of tooth development and eruption. In 1932 Hellman[10] showed sex differences in orthodontic patients. He noted here that the female patient was more prognathic than the male patient of the same age. In 1935[11] he demonstrated that there are three factors which contribute to the modification of the face from infancy to adulthood: (1) increase in size, (2) change in proportion, and (3) adjustment in position. He pointed out that these changes continued in boys after they had stopped in girls.

In 1939 Krogman[12] observed that growth is not uniform but differential and proportional. In 1951[13] he stated that, in terms of Hellman's dental age, girls enter pubescent growth about one dental age ahead of boys and that they tend to complete their growth before the boys.

A group of more recent papers dealing with some phases of differential growth of facial parts or sex difference in gradient and timing will now be reviewed.

Baird[14] compared the skeletal and dental patterns of a group of 7- to 9-year-old children with excellent occlusions with those of a group of 11- to 13-year-olds. He found that when younger boys were compared with older boys, over-all facial patterns were essentially the same except for increases in size. Facial patterns of the girls were significantly different, however, in that the older group had less convex faces and more upright incisors as well as increases in size and higher facial angles. In both groups the mandible grew more than the maxilla.

Barnes[15] studied a group of children with excellent occlusions from 12 to 15 years of age and found that the boys exhibited a significant increase in linear length of the maxilla and mandible. The girls showed no increase in maxillary length but an increase in mandibular length, resulting in less convex faces. Also, the skeletal patterns of both male and female faces changed in positional relationship, the mandibles becoming increasingly more protrusive and the profiles less convex. The boys in this age range developed less protrusive dentures as a result of the maxillary incisors becoming more upright. No change could be found in the dental pattern of the girls.

Björk[16] conducted cephalometric studies on 150 boys examined at age 12 and again at age 20. On the basis of these studies and of an earlier cross-sectional cephalometric investigation of "12-year-old boys and an approximately equal number of adult males" totaling 603 cases, he stated that an increased prognathism of both jaws was characteristic of profile changes with age and that the increase is greater in the mandible than in the maxilla. Thus the Swedish boy's profile becomes straighter as the boy matures.

Brodie,[17] in a longitudinal study of a group of nineteen boys from the age of 8 years to the age of 17 or beyond, found that the late stages of growth are accompanied by a continuation of forward and downward movement of the anterior nasal spine and of pogonion, while the dental arch and its supporting bone tend to move more slowly and thus to drop behind. This decreases the prominence of the denture.

Davis[18] examined fifteen girls and twenty-one boys with good to excellent occlusions in the seventh to the twelfth years. His analysis of the change in location and position of the lower central incisors from typical mandibles, oriented at menton, showed that the incisal edge and the labial surface become more retrusive in relation to chin point.

In 1956 Downs[19] stated: " . . . in normal growth the lower face or mandible moves forward at a greater rate than the maxilla, thus increasing the facial angle from 82 degrees to 88 degrees and decreasing the angle of convexity from +10 degrees to 0 degrees. Vertical growth is greater in the area of the ramus than at the profile, thus decreasing the mandibular plane angle from 28 degrees to 22 degrees."

Downs commented further on sex difference in growth: "Routine checking of cases following treatment has consistently shown that females have minimum facial changes in size or proportion after 14 to 15 years. Males, on the other hand, consistently continue growth and development until twenty. Gnathion may move downward along the Y axis as much as ½ inch and the angle of convexity may change several degrees."

Lande[20] made a longitudinal study of thirty-four boys with a mean age span of 4.4 to 17.1 years. He calculated mean changes and found that the mandible became more prognathic in relation to both nasion and maxilla during growth. He also concluded that the convexity of the face nearly always decreased.

Lavin,[21] in a study of 100 white children aged 11 to 21 years, equally divided as to sex, showed that pronounced correlated incremental changes at glabella and at the symphysis were common in boys during the entire period of this study, whereas there were less pronounced changes in girls and the majority of the girls showed no change after the age of 15 years.

Lundell[22] compared boys and girls (in separate groups and together) aged 7 to 9 years with boys and girls (also in separate groups and together) aged 10 to 12 years. Changes in common were an increase in the facial angle and a decrease in the angle of the maxillary incisor. In girls, however, the angle of the axis of the upper central incisor to the lower central incisor increased significantly.

McNair[23] found that the greatest amount of vertical facial growth occurred between the ages of 12 and 13 in boys and 11 and 12 in girls. He studied 107 untreated children with excellent occlusions—fifty boys and fifty-seven girls from 7 to 14 years of age.

Meinhold[24] studied the skeletal patterns of a group of children with excellent occlusions. His group included nine boys between the ages of 12 and 19 and eight girls between the ages of 12 and 18. The children were studied serially during three successive age periods: (1) 12 to 15 years, (2) 15 to 16 years, and (3) 16 to 18 years (girls) and 16 to 19 years (boys). Angular and linear measurements were made. The findings may be summarized as follows:

> The relative growth of the boys was greater in all directions than that of the girls. As a group, the boys showed growth during all three age periods studied, with all growth during the third age period confined to the lower face. The girls showed no growth of any consequence after the first age period.
>
> The skeletal pattern of both boys and girls changed in positional relationship. The mandible became increasingly more protrusive. The convexity of the facial profile decreased, with the boys maintaining more convex faces than the girls throughout. The relative forward growth of the mandible was greater than that of the maxilla. The boys maintained relatively longer faces than the girls, who maintained relatively deeper faces.

Petraitis[25] compared facial and dental patterns of 12-year-old boys and girls with those of adult men and women. The facial patterns of boys were significantly different from those of men, but the facial patterns of girls were not significantly different from those of grown women except in size.

Schaeffer[26] studied the behavior of the upper and lower incisors during growth from forty-seven series of lateral headplates from the Bolton Foundation. The sample is described as consisting of ''untreated cases'' from the first occlusion of incisors for eight following years. Schaeffer showed that, regardless of the behavior of their axes, the incisor teeth come to occupy a relatively more posterior relationship to their supporting bones with growth of the facial skeleton.

Schultz[27] found that the convexity of the face decreased during growth; the mandible moved forward at a faster rate than the maxilla, with chins going forward at a significantly faster rate in boys than in girls. A significantly greater relative growth rate was shown in all vertical and horizontal

measurements for boys than for girls in this study. The sample studied consisted of twenty-one children (eleven boys and ten girls) aged approximately 12½ to 16½ years, studied longitudinally over a four-year period.

Seal[28] studied growth in two groups of children with excellent occlusions between the ages of 8 and 18; children in Group 1 were 8 to 13 years old and those in Group 2 were 13 to 18 years of age. Sex and age differences were studied. Seal found that (1) boys are larger than girls, and their growth is greater in terms of actual size; (2) the maxilla appeared to be longer (in terms of percentage of facial depth) in girls than in boys throughout the age period studied, although sex differences became progressively less significant as the age level increased; (3) the mandible, in relation to the maxilla, grows at a greater rate, resulting in a progressive decrease in convexity of the facial profile in both boys and girls; (4) by age 18 the girl has developed a greater degree of mandibular prognathism than the boy; (5) in terms of the mechanism of growth, both sexes present the same pattern, the only difference being one of timing and duration (that is, the maximal growth period of the girl is between 8 and 13 years of age and seems to start earlier and to be of shorter duration than that of the boy, whose maximal growth period is between 13 and 18 years of age).

Soft-tissue facial structures have been considered recently in cephalometric surveys by several authors. Burstone[29] published "integumental angular means, standard deviations, ranges, and standard errors of mean of acceptable young adult profiles" drawn from a sample of fifteen males and twenty-five females who were selected because of their "acceptable or better" faces.

Subtelny[30] studied the profile characteristics of soft-tissue facial structures and their relationship to underlying skeletal structures in a longitudinal cephalometric investigation of thirty subjects with "normal profiles" from the Charles Bingham Bolton Study at Western Reserve University. The sample, equally divided as to sex, was recorded at intervals of from 3 months to 18 years. In general, Subtelny found that:

1. At 18 years of age there were no striking differences in soft-tissue or skeletal mandibular prognathism between boys and girls. However, at 7 or 8 years of age the boys showed only one-half the amount of prognathism that they would achieve by 18 years, while the girls had already expressed three-fourths or more of the amount that they would achieve by 18.
2. In both sexes the skeletal profile tended to become less convex with increment in age.
3. The prominence of the nose tended to increase in comparison with increments at chin and frontal prominence; however, no sex differences were found.*
4. The pattern of nose growth and the location of the tip of the nose, when studied by linear measurement, were found to vary between boys and girls at certain ages. In twelve of fifteen boys there was described a "growth spurt" which "seemed to center around 13 to 14 years." A similar spurt was evident in only three of fifteen girls and was "observed to center around 12 years of age."
5. Both mandibular and maxillary dentures became less protrusive with increment in age.

*It should be noted with reference to the lack of sex differences found here that concomitant sex-differentiated increments at chin point, which might be expected at this age, would have masked sex differences in forward growth at the tip of the nose, when measured by the angle of convexity type of measurement, such as was employed here.

Bowker[31] described a metric method for depicting the soft-tissue profile in vertical and horizontal projections and presented the results of a comparison of a group of twenty-six girls and twenty-two boys measured at 5 and 14 years of age. His findings pertinent to this study were as follows:

1. Mean distance from nasion to pogonion was greater for boys than for girls at each of the ages studied.

2. The distance from a line from nasion to pogonion (facial plane) to the tip of the nose increases more than the distance from this line to the tip of the chin, but no sex differences were found.

3. "For none of the five dimensions measured (horizontally from facial plane) is there a statistically significant difference between the distributions on girls and boys. At age 14 years the only statistically significant difference is that between the means for distance from nasion to pogonion line to the root of the nose ($T = 2.0$)." This dimension was larger in the boys than in the girls.

It should be pointed out that since only two age levels were considered in Bowker's study, it is impossible to rule out sex differences at other ages. As noted earlier in the summary of bibliographic material relative to hard-tissue profile, sex differences do occur after the age of 5 and before the age of 14. In order to demonstrate such differences, however, data between these two ages are needed.

Concerning late changes, Baer[22] studied changes in facial dimensions of 5,600 men and 7,420 women during the third decade of life. He was able to demonstrate significant increases in facial height, nose height, and bizygomatic width in the men, but no such increases could be shown in the women.

There is apparent here a well-ordered and predictable pattern in the dentofacial changes that accompany growth and development. First, there is a period which might be called the period of primary growth or growth in which sex is not a variable. This is followed by a period during which the adult pattern begins to assert itself—one which might be called the period of developmental growth, since it involves both increase in size and progress toward maturity. The developmental growth period is sex–time linked, beginning and ending earlier in girls than in boys and probably progressing farther in boys.

The progressive development of the adult complex has certain general characteristics: The adult dentofacial relationship differs from that of the child in that the adult has a less convex face, a more protrusive denture with more upright incisors, and a more prognathic mandible. In the male, these effects appear later, continue longer, and produce more marked changes.

Thus, a "Three-L" postulate of boys' growth patterns might be formulated: Boys grow later, longer, and larger.

METHODS AND MATERIALS

The prime objective of this study was to determine the fate of the denture of a successfully treated orthodontic patient in relation to the subjectively considered "rest of the face" during the posttreatment period of developmental growth.

Specifically, the hypothesis is that when orthodontic treatment is completed prior to or during the period of developmental growth, there follows a progressive change in the location of the denture in relation to other profile structures. The rate of change and the age at which change occurs are different for boys and for girls. Thus, the pattern of dentofacial changes during developmental growth in a patient after orthodontic treatment is similar to those that have been shown in untreated persons.

The sample consisted of forty-four treated orthodontic patients—twenty-three boys and twenty-one girls. Selections were based on the following criteria:

1. An original malocclusion of a major order of severity, without regard to classification of malocclusion.
2. Successfully completed orthodontic treatment, that is, occlusion normal as described by Angle,[33] overbite and overjet within the normal range described by Stedman,[34] and face in good balance.
3. Uneventful retention and postretention periods, with no serious tendency toward relapse in occlusion, overbite, or alignment and no change in arch length.

Criteria for selection of the sample were purposefully maintained at a very high level, so that results would apply to the highest order of successfully treated orthodontic cases.

Lateral headplates were obtained by standard cephalometric roentgenographic techniques. Measurements were made from tracings.

The age recorded for each patient is the age at which active orthodontic treatment was completed and appliances were removed. The first headplate was taken at this time. The age range was 11 years to 17 years. Retaining devices were of various types and were worn for various periods of time; without exception, they had been completely discontinued for at least one year prior to the second headplate. The mean time interval between headplates was 37.4 months; the median time interval was 30.5 months.

The relative prominence of the oral area in profile depends on the anteroposterior location of the anterior teeth with regard to nose and chin. It was therefore necessary to devise a system of reliable profile measurements which would express this relationship and demonstrate variability.

The following method proved to be the most demonstrative and the least susceptible to mechanical error in transfer from one tracing to another (Fig. 1). A vertical plane was drawn at right angles to the sella-nasion plane and tangentially to the most anterior point on the labial surface of the upper central incisor. This was named the upper central incisor plane. Horizontal metric measurements could then be made from this plane to both integumental and skeletal profile landmarks, which would express changes in the linear distance between the end points without regard to the locus of the change. The following measurements were recorded: (1) distance from the upper central incisor plane to the tip of the nose, (2) distance from the upper central incisor

plane to pogonion (bony chin point), and (3) distance from the upper central incisor plane to the most everted point on the profile of the soft-tissue chin.

The profile of the lips was deemed too unreliable to be used as a determinate landmark in this study, since it could be varied to a considerable extent by the patient under the instruction or at the suggestion of the operator. It was pointed out earlier that lip contour is related to underlying tooth position; therefore, the upper central incisor plane seemed a more reliable base line.

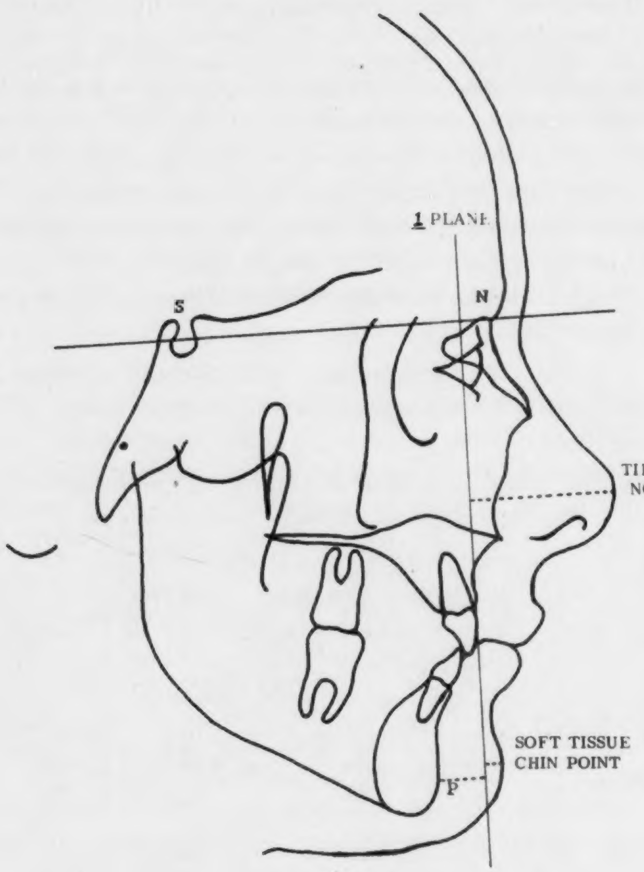

Fig. 1.—Measurements used in this study.

In order to demonstrate the difference between boys and girls in rate of change for these measurements, the longitudinal difference between headplates was computed for each subject. Since time between headplates necessarily varied in the framework of a private practice, it was arbitrarily decided that the study should include only those subjects whose second headplates were obtained after the fifteenth year, which was accepted as being subsequent to the period when sex has its greatest influence on growth.

The graphs which follow (Figs. 2, 3, and 4) show the mean change in these readings for each age at the time of the first headplate. They demon-

strate the amount of change in dentofacial relations after treatment for a group of cases separated as to sex and tabulated as to age at the time of completion of treatment.

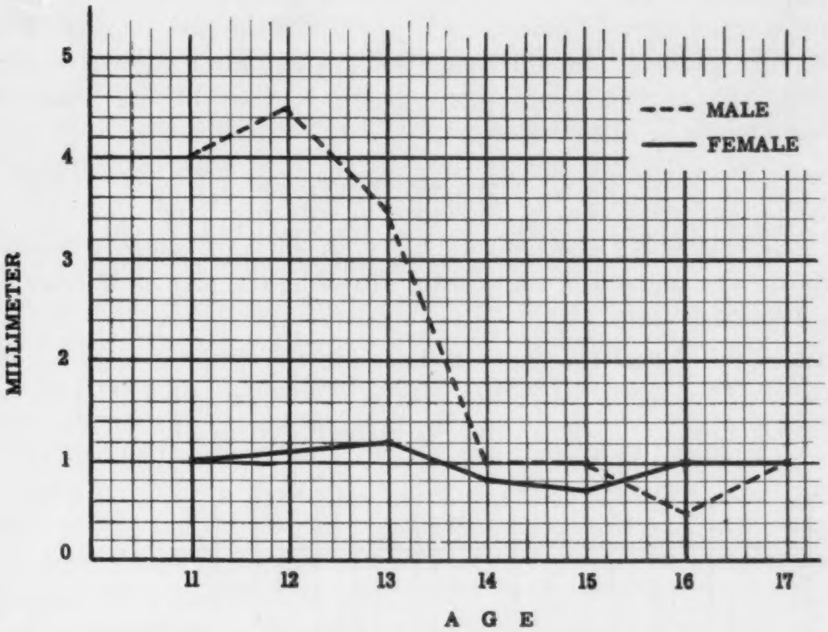

Fig. 2.—Mean linear change in the distance from the upper central incisor plane to the tip of the nose.

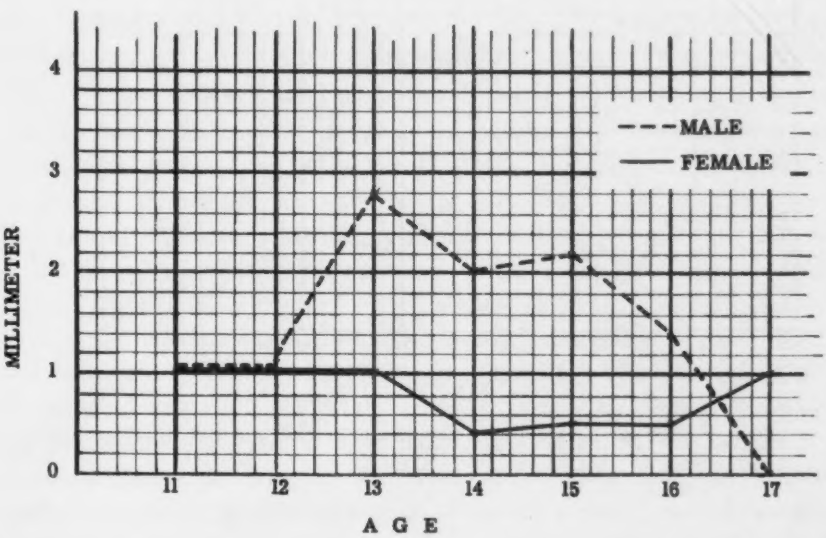

Fig. 3.—Mean linear change in the distance from the upper central incisor plane to pogonion.

It should be re-emphasized that the values shown in the graphs are the mean changes in the measurements used and not the absolute values of the measurements.

FINDINGS

1. Distance From Upper Central Incisor Plane to Tip of Nose (Fig. 2).—There was a linear change, as well as a difference in rate of change, for boys and girls during the developmental growth period. The boys in this group showed a mean forward movement of the tip of the nose of about 4 mm. after the eleventh, twelfth, and thirteenth years. The girls showed negligible changes during this period. Subsequent to the fourteenth year there were no striking differences in rate of change.

2. Distance From Central Incisor Plane to Pogonion (Fig. 3).—There was a linear change, and there was a difference in rate of change for boys and girls. The bony chin point moved forward a mean distance which was greater in the boys after the thirteenth, fourteenth, fifteenth, and sixteenth years than in the girls after these years.

It should be noted that the greatest change in the distance from pogonion to central incisor plane occurred in the boys at a later age than the change in distance from the nose to the central incisor plane shown in Fig. 2.

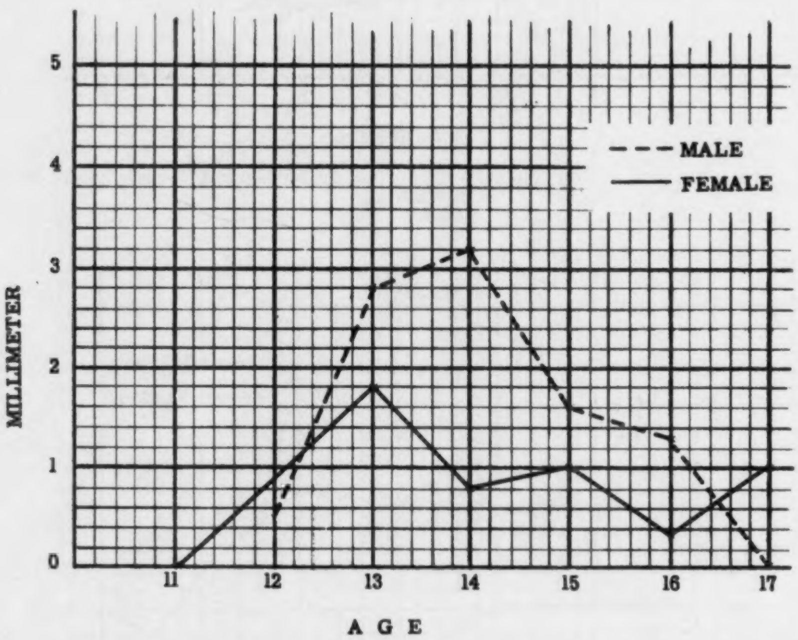

Fig. 4.—Mean linear change in the distance from the upper central incisor plane to soft-tissue chin point.

3. Distance From Upper Central Incisor Plane to Most Everted Point on Profile of Soft-Tissue Chin (Fig. 4).—The changes shown in soft-tissue chin point increments parallel those shown above for the hard-tissue chin point. After the thirteenth, fourteenth, fifteenth, and sixteenth years the boys showed an increase in this measurement, while during this same period the girls showed relatively little change.

DISCUSSION

The findings substantiate the hypothesis set forth earlier, namely, that when orthodontic treatment is completed before or during the period of developmental growth a progressive change in location of the denture in relation to the rest of the face can be expected. The denture will become progressively less protrusive.

In an article published in 1951[6] I commented: "It is important that we appreciate differences between the skeletal and denture patterns of children, and those of adults. The ideal of treatment should be a denture pattern within the limits of the skeletal pattern, again evaluated by comparison to a normal range for that particular age group."

It appears, from the findings of this study, that in framing the "ideal of treatment" there must be yet another consideration—the sex of the patient.

The degree to which these effects will be expressed depends on the developmental growth level at which treatment is finished. This level is, to a considerable extent, determined by the age and sex of the patient.

As implied by previous studies and demonstrated by the results of the present study, the denture of a male orthodontic patient will retreat into the enveloping facial structures to a degree dependent on the patient's level of developmental growth. This level can reliably be expected to be lower in a boy of a given age than in a girl of comparable age.

Thus, the ideal location of the denture for a 13-year-old boy should be planned with the expectation that in the succeeding months the developmental growth changes will carry the rest of the facial structures forward relative to the denture to a greater degree than would be true in a girl of similar age.

Fig. 5 shows the superimposed tracings of a representative male patient who was 13 years 10 months of age when orthodontic treatment was completed. The second headplate was taken at 17 years 5 months. Measuring from the central incisor plane, the distance to the tip of the nose has increased 4 mm., the distance to the bony chin point has decreased 3 mm., and the relationship to the soft-tissue chin point has changed from -1 to +2 mm.

Fig. 6 shows the superimposed tracings of a representative girl who was 13 years 6 months of age when orthodontic treatment was completed. The second headplate was taken at 17 years 2 months. Differences here are practically insignificant, but they tend in the opposite direction toward a more protrusive denture.

It should also be pointed out that as absolute size of the surrounding structures increases, prominence of the denture becomes minimized by comparison. This effect can be seen in Fig. 7, which shows Björk's[16] superimposed diagrams of boys and conscripts. As seen in Fig. 6, a girl at this age often has no prospect of an increase in size of facial structures.

In spite of Wylie's[35] recent "jaundiced" look at nondental diagnostic criteria, a discussion of the determination of developmental growth level by means other than predictions based on age and sex seems germane here.

Ludwick[36] showed that mandibular growth increments closely followed the statural growth pattern. Thus, an examination of physical anthropologic work in the field of growth prediction might well provide the orthodontist with additional evidence to help in fixing the developmental growth level of an individual patient at the end of treatment and hence disclose the amount of reorientation of dentofacial relationships to be anticipated.

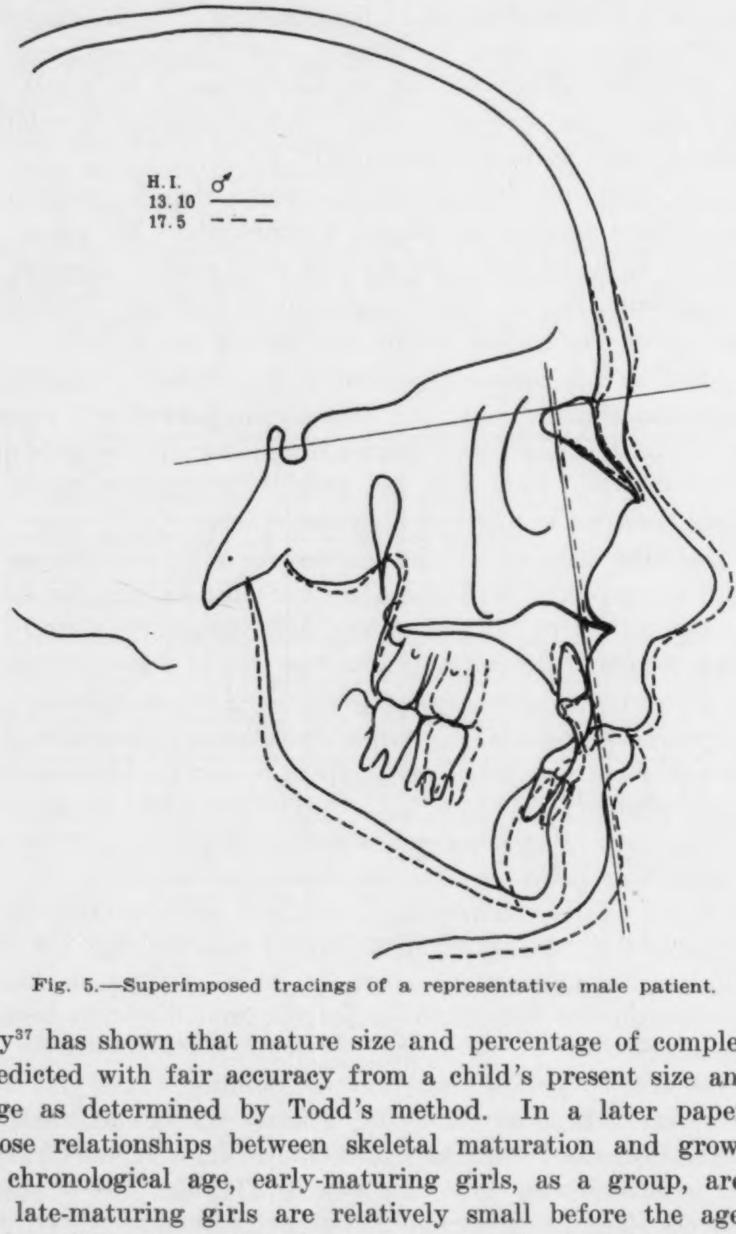

Fig. 5.—Superimposed tracings of a representative male patient.

Bayley[37] has shown that mature size and percentage of completed growth can be predicted with fair accuracy from a child's present size and from his skeletal age as determined by Todd's method. In a later paper, Bayley[38] showed close relationships between skeletal maturation and growth in size. Rated by chronological age, early-maturing girls, as a group, are relatively large and late-maturing girls are relatively small before the age 13 years, whereas after this age relative sizes are reversed. Early-maturing boys are relatively large at all ages. Thus, a boy who is "small for his age" may be expected to be at a lower level of developmental growth than a 12-year-old girl who is "large for her age."

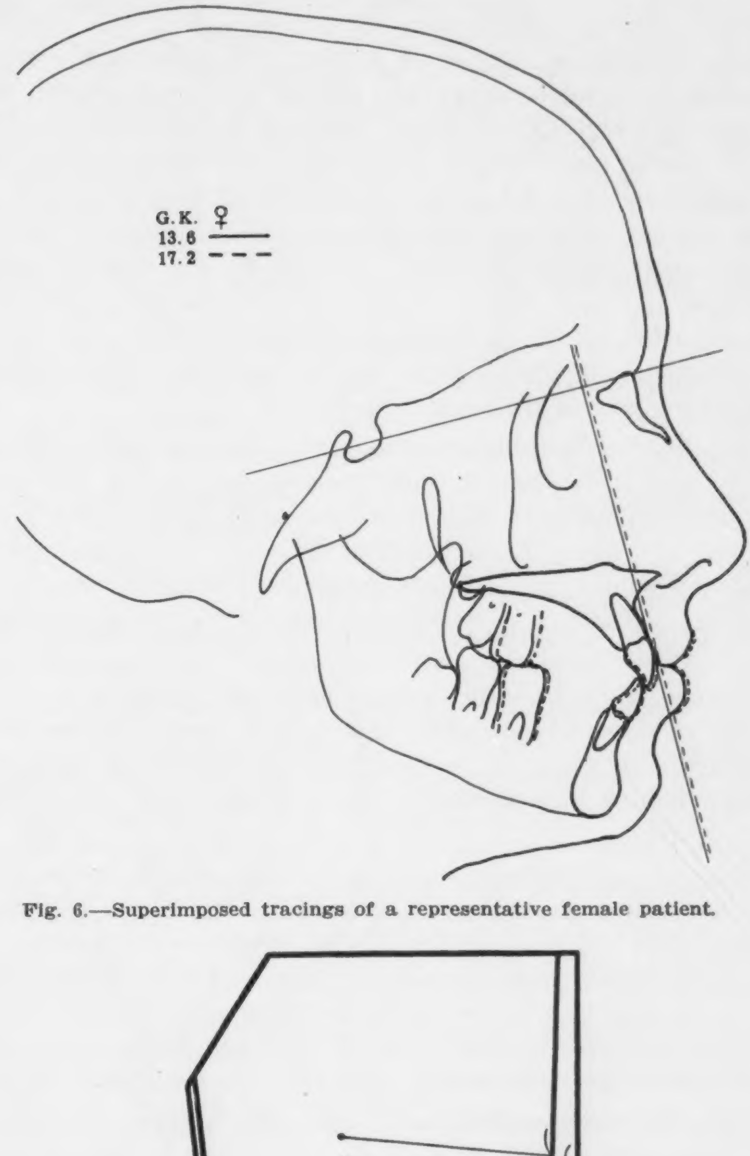

Fig. 6.—Superimposed tracings of a representative female patient.

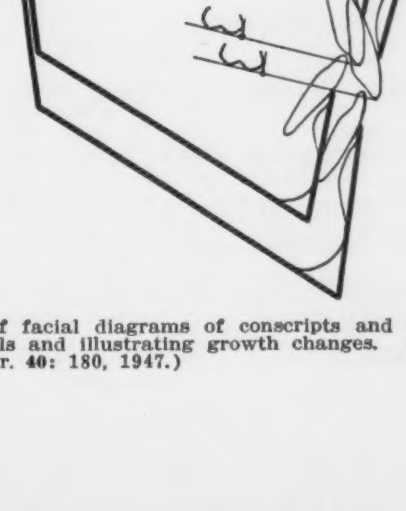

Fig. 7.—Comparison of facial diagrams of conscripts and boys, based upon the mean values for the two materials and illustrating growth changes. (After Björk: The Face in Profile, Svenska tandl.-tidskr. 40: 180, 1947.)

Krogman[39] discusses the findings of several authors with respect to level of sexual development in relation to growth expectation and concludes that, in general, sex maturation signals the end of significant growth increments. Thus, children at a high level of sexual maturity for their age may be expected to have little growth potential and little prospect of further dentofacial change.

It is interesting to note that the sex-defined pattern of growth is present, as well, in the age at which statural growth is completed. Nicholson and Hanley[40] reported that in American children 99 per cent of adult stature was achieved at 16.4 years for boys and 14.6 years for girls. This agrees with the figures reported by Bayley,[38] who found that at 15.2 years boys have attained 96.59 per cent of their mature height—whereas at 13.2 years girls have attained 96.56 per cent of their mature height.

The fact that relationships can be shown between general body growth and development, facial growth and development, and a measure of predictability does not imply a suggestion that these anthropometric criteria be put into the "philosophy of orthodontic diagnosis" on a quantitative basis. Nonetheless, it would seem foolhardy to ignore the fairly broad hints which the level of physical maturity provides concerning the fate of the denture after treatment.

The denture of an immature patient must be placed in an "immature" location, that is, more forward than in a mature face. Placing an immature patient's denture in an adult relationship can only result in a further retrusion of the denture into the face as the inevitable facial maturation changes take place.

For most of our patients orthodontic treatment is commonly finished during the very years when these differences in dentofacial behavior operate. A distinction must be made in dentofacial relations and possibly in upper incisor to lower incisor relations between boys and girls during these years. Failure to do so may lead to the unpleasant experience of watching helplessly while the face of a male patient becomes more and more concave as his lips retreat and his nose and chin achieve their adult proportions.

From the foregoing findings and discussion, a generalization might be permitted: The denture of a 13-year-old girl should be placed farther back than that of a 13-year-old boy. Similarly, a 13-year-old boy can accept a fuller dental area than a girl of the same age, since the girl probably will experience little or no change in distance from the central incisor plane to the nose and chin point while the boy can expect a significant increase in these distances.

SUMMARY AND CONCLUSIONS

1. Recent work in differential and sex-variable growth is reviewed, and the general pattern of developmental growth is discussed. A "Three-L" postulate of boys' growth patterns is proposed: Boys grow later, longer, and larger.

2. A method of measuring anteroposterior location of the anterior teeth in relation to the nose and to the soft-tissue and bony chin points is presented.

3. Mean changes in these measurements are shown for a group of forty-four successfully treated orthodontic patients tabulated as to age and sex.

4. The findings indicate that the dentofacial relationships subsequent to orthodontic treatment follow the general pattern of developmental growth and, to some extent, are predictable from the age, sex, and developmental level of the individual patient.

Active orthodontic treatment is commonly completed during a period when boys are experiencing developmental growth changes which bring about a more retruded denture, whereas these changes have usually been effected in girls of the same age.

Thus, it can be expected that in boys of this age range the denture and consequently the dental area will retreat into the face after treatment, resulting in a continuously less convex face as growth continues. This effect should be anticipated in treatment planning.

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10962 LE CONTE AVE.

PERIORAL PROFILE CHANGES IN ORTHODONTIC TREATMENT

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THE relationship between orthodontic tooth movement and changes in the soft-tissue profile veneer around the mouth is not clear.

Altering the dentoskeletal framework by orthodontic therapy may produce desirable or undesirable changes in the soft-tissue contours. The specific areas affected, however, and the factors which produce these changes, are still not clearly identified. Since facial esthetics is one of the prime objectives of treatment, orthodontic diagnosis and treatment planning are influenced by the existing concepts of the relationships between the skeletal, dental, and soft-tissue structures. Because this soft-tissue mass plays an important part in the muscular balance of the lips, the stability of the anterior teeth, and esthetic harmony, a thorough understanding is certainly advantageous.

Although almost every orthodontist has been aware of integumental changes occurring with treatment, there are two concepts which may be responsible for the relatively meager investigation that has been done in this area. First, orthodontic treatment is primarily concerned with the hard-tissue manipulations and, second, it has been assumed that if the teeth are arranged to a given standard soft tissue will automatically drape in a most harmonious manner.[1]

Controversy exists over the relationships of the hard and soft tissues. Riedel[2] has stressed that the soft-tissue profile is closely related to the skeletal and dental structures; Subtelny[3] indicated that not all parts of the soft-tissue profile directly follow the underlying skeletal profile; Burstone[4] has suggested that a direct relationship may not always exist because of the variation in the thickness of the soft tissue covering the skeletal face; Stoner and associates[5] concluded that the recontouring of the lips seemed to occur because of the gross movement of the incisor teeth; Neger[6] stated that a proportionate change or improvement in the soft-tissue profile does not necessarily accompany extensive dentition changes; and Wylie[7] concluded that modification of the facial profile by orthodontic means does not depend on the inclination of anterior teeth.

Growth changes of the subcutaneous tissue have also confused the problem. Hellman[8] found a loss in the subcutaneous tissue in girls and boys beyond 16 years of age. His measurements showed either no increase or an actual diminution in girls. In boys, the bony increments seemed about equal to the disappearance of subcutaneous fat. Subtelny[3] found that the soft-tissue thickness over-

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lying bony point A in three-year periods, from 9 to 18 years of age increased by an average of slightly more than 1 mm. in boys and slightly less than 1 mm. in girls.

In addition, a number of problems are associated with the establishment of a significant relationship between a change in dentoskeletal structures and adjacent soft-tissue profile. Among these are the following:

1. Separate analyses of either soft-tissue or dentoskeletal patterns alone have proved inadequate or misleading.
2. Total facial profile appraisal is too generalized, as the localized effects are obscured.
3. Use of reference planes, such as the Frankfort horizontal, sella turcica-nasion, and nasion-pogonion, tends to mask a local change in the region around the mouth due to over-all growth factors.
4. Angular measurements, especially those of the central incisors, can be deceptive, as the root apices do not always remain in their original positions.

The purpose of the present investigation was to clear away some of the haze that obscures this problem by evaluating the correlation between the movement of teeth and the changes in the perioral soft-tissue profile.

This problem can be measured by means of numerous approaches and combinations. The main considerations are (1) direct measurement of the patient, (2) oriented photographs, (3) oriented facial and dental casts, and (4) roentgenographic cephalometry.

The accuracy of the method is reduced when the hard- and soft-tissue structures are recorded and measured separately, as is the situation in the first three methods.

The approach chosen for the present study was that of cephalometric analysis. Before- and after-treatment tracings were evaluated by accurate superimposition, registration, and templating methods. An advantage of this method was that hard and soft tissues could be measured in one procedure. The area of study was focused on the dentoskeletal and soft-tissue structures surrounding the mouth. This technique of local or regional comparison minimized growth factors.

METHOD AND MATERIAL

A sample of sixty orthodontically treated American white patients was selected according to cephalometric films which revealed (1) good hard- and soft-tissue structures; (2) teeth in full occlusion; (3) lips resting in natural position (as verified by profile photographs); and (4) no orthodontic appliances in place.

There was an equal distribution as to sex—thirty boys and thirty girls. The average age before treatment was 11 years 6 months, with a range from 8 years 0 months to 16 years 0 months. The average age after treatment was 14 years 10 months, with a range from 11 years 3 months to 19 years 10 months.

As the main interest was in the net change in the structures, no differentiation was made between the extraction and nonextraction groups. The extraction group, which made up 25 per cent of the sample, was limited to four premolar extractions only.

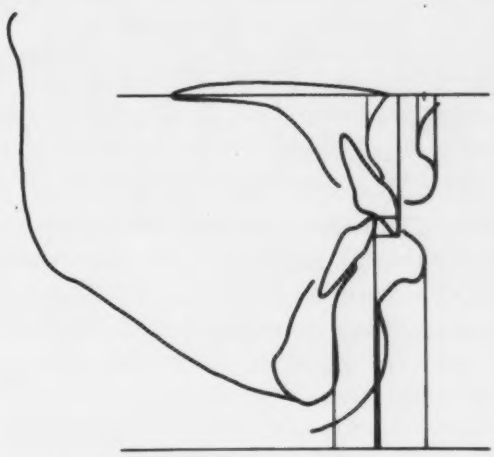

Fig. 1.—The before-treatment tracing.

The landmarks used were as defined by Downs,[9] Cunningham,[10] and Krogman and Sassouni.[11] The before-treatment construction was traced in the following fashion (Fig. 1):

The palatal plane:* A line connecting the anterior and posterior spines. Perpendicular lines from the palatal plane, extending inferiorly, were constructed to the following landmarks:

1. *Point A*—The deepest midline point on the premaxilla between the anterior nasal spine and prosthion.
2. *The maxillary central incisor*—The most anterior point of the most prominent maxillary central incisor.
3. *The superior labial sulcus*—The deepest point on the upper lip between subnasale and the upper lip.
4. *The upper lip*—The most anteriorly prominent point on the upper lip.

The projected palatal plane: A line drawn below the mandible that is the parallel component of the palatal plane of the hard palate. Perpendicular lines from the projected palatal plane, extending superiorly, were constructed to the following landmarks:

1. *Point B*—The deepest midline point on the mandible between infradentale and pogonion.
2. *The mandibular central incisor*—The most anterior point of the most prominent mandibular central incisor.

*This was selected as the plane of reference because it is readily established. It approaches a horizontal position in erect posture and thereby aids in the visualization of the profile components in space, and it is a guide to the orientation of hte maxilla. [1]

3. *The inferior labial sulcus*—The most concave point between the lower lip and the chin.
4. *The lower lip*—The most anteriorly prominent point on the lower lip. This perpendicular line is extended superiorly, to be registered on the palatal plane above, for measurement in comparison to the upper lip.

Overjet: A horizontal measurement along the line drawn parallel to the palatal plane (at the level of the incisal edge of the mandibular central incisor), as confined within the vertical lines to the most prominent maxillary and mandibular central incisors.

Overbite: A vertical measurement along the line drawn perpendicularly from the palatal plane (to the most prominent maxillary central incisor), as confined within the horizontal lines to the incisal edge of the mandibular and maxillary central incisors.

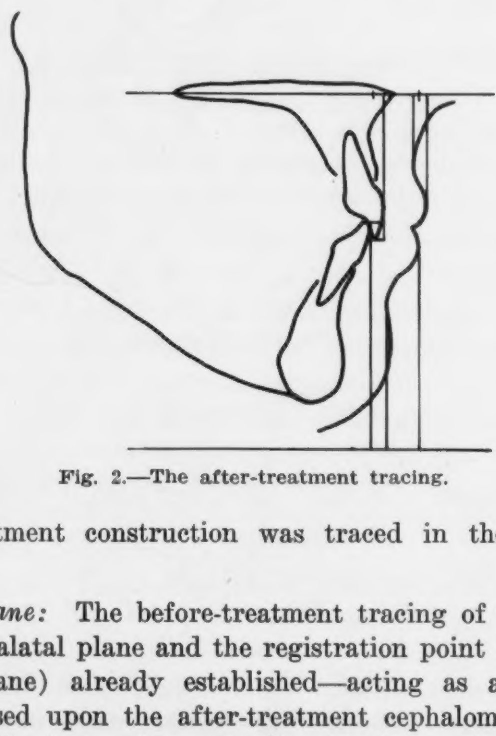

Fig. 2.—The after-treatment tracing.

The after-treatment construction was traced in the following manner (Fig. 2):

The palatal plane: The before-treatment tracing of the hard palate with the palatal plane and the registration point (point A on the palatal plane) already established—acting as a template—was superimposed upon the after-treatment cephalometric film. The best individual superimposable landmarks, such as the anterior nasal spine, identical structures of the floor of the nose, and the palate, were relied upon. A blank piece of tracing paper was placed over the film and the before-treatment superimposed tracing. The after-treatment tracing was then drawn, recording the hard palate, the palatal plane, and the registration point (original point A) in the same relationship.* Now all measurements were

*The registration point was selected in this manner because point A changes in many cases.

recorded along the same plane (the palatal plane) and from the same registration point (point A of the before-treatment tracing).

The maxillary central incisor, the superior sulcus, and the upper lip were all recorded in the manner previously described.

The projected palatal plane: Because of the growth factors of the mandible, it was necessary to superimpose the mandible of the before-treatment tracing on the after-treatment film. The anterior half of the lower border and the symphysis of the mandible were used. A clear piece of tracing paper was taped over the film and the before-treatment tracing. The after-treatment tracing was then drawn, recording the superimposed structures of the mandible, the projected palatal plane, and the registration point (point B of the before-treatment tracing). The measurements were then in the same relationship to the mandible and could be recorded along the same plane (the projected palatal plane) and from the same registration point (point B of the before-treatment tracing).

The remaining measurements were recorded in the manner previously described for the before-treatment tracing.

The linear measurements recorded from the before- and after-treatment tracings in order to obtain a net change result included the linear change of (1) the upper incisor, (2) the superior sulcus, (3) the upper lip, (4) the superior sulcus to the upper lip, (5) the upper lip to the lower lip, (6) the lower incisor, (7) the inferior sulcus, (8) the lower lip, (9) the inferior sulcus to the lower lip, (10) overbite, and (11) overjet.

Upon completion of the data, the relationship between the hard and soft tissues was estimated from mean net changes and scatter diagrams. For a more accurate analysis, a coefficient of correlation was computed.

FINDINGS

The net change values obtained from the original data were plotted on scatter diagrams which gave information as to how the incisors were related to the soft-tissue profile. Figs. 3 and 4 show the degree of relationship between the net changes of the incisors and the lips.

The pattern of these scatter diagrams indicates a definite association, as the points follow a line of movement or path which suggests a straight line. From this, one could expect a significantly high correlation and a means of predicting the expected amount of change.

The coefficients of correlation were computed as follows:

1. The linear change of the upper incisor to:

A. The superior sulcus	.89
B. The upper lip	.87
C. The lower lip	.82
D. The superior sulcus to the upper lip	.89
E. The upper lip to the lower lip	.73

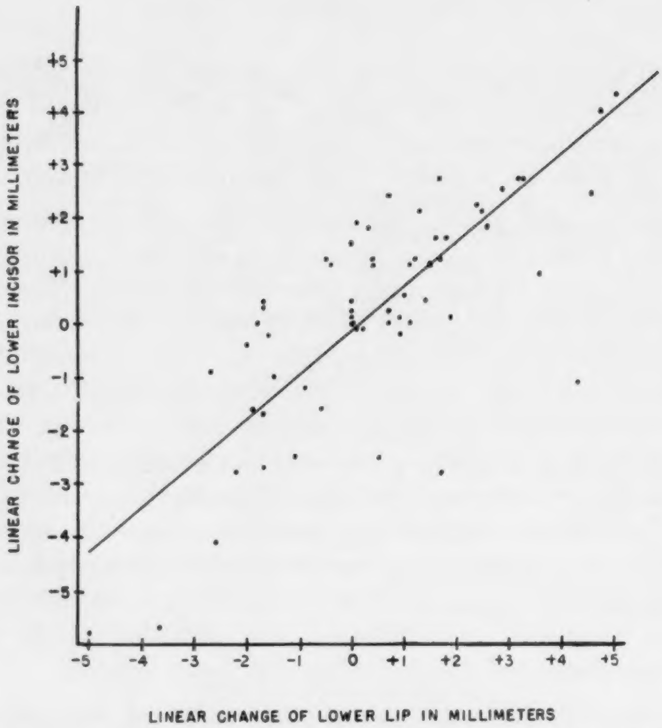

Fig. 3.—Scatter diagram showing the relationship between the net change of the lower incisor and the lower lip. Plus values represent amount of labial movement, and minus values designate amount of lingual movement. It is observed that the lower lip closely follows the movement of the lower incisor.

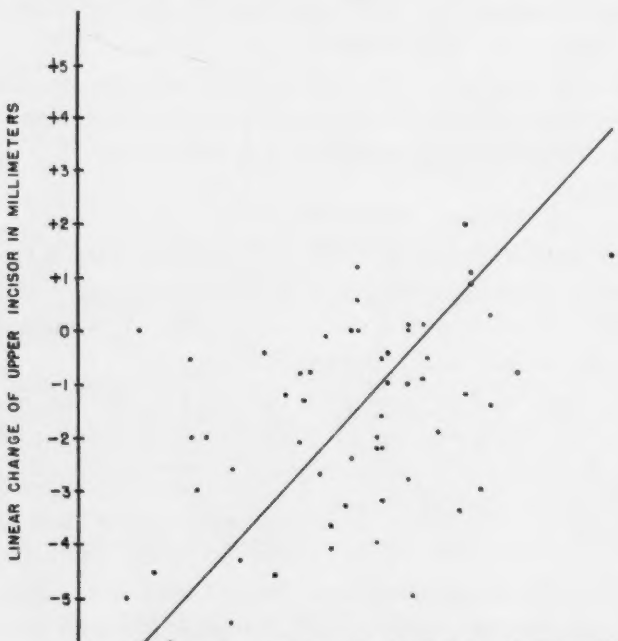

Fig. 4.—The net change of the upper incisor is plotted against the net change of the upper lip. Plus values represent amount of labial movement, and minus values represent amount of lingual movement. The upper lip movement does not follow so closely to that of the movement of the upper incisor.

2. The linear change of the lower incisor to:
   A. The inferior sulcus .87
   B. The lower lip .93
   C. The inferior sulcus to the lower lip .87
3. The linear change of overbite to:
   A. The upper lip to the lower lip .82
4. The linear change of overjet to:
   A. The upper lip to the lower lip .91

The calculated coefficients of correlation ranged from .73 to .93, which is far greater than the 1 per cent level of significance. Statistically, this shows the very high relationship that exists.

These results indicate that the soft-tissue response is closely related to that of the orthodontically moved hard-tissue structures (Figs. 5 and 6).

Fig. 5.

Fig. 6.

Fig. 5.—Superimposed before- and after-treatment tracings of the maxilla, the maxillary central incisor, and the soft-tissue profile. The upper and lower lips are found to follow the orthodontic movement of the maxillary incisor.

Fig. 6.—Superimposed before- and after-treatment tracings of the mandible, the mandibular central incisor, and the soft-tissue profile. The lower lip is found to follow the orthodontically moved mandibular incisor.

DISCUSSION

The practical value of knowing the high relationship that exists between the orthodontically affected hard and soft tissues lies in estimating the changes in the perioral soft-tissue profile. This can be accomplished by means of a regression equation[12] with the range established by the standard error of estimate,[13] or it can be done by scatter diagrams.

The amount of expected change for either the upper or the lower lip can be obtained from the scatter diagram (Fig. 3 or Fig. 4) by selecting any theoretical value of movement for the incisor and reading across to the diagonal line (the line of regression) and then down to the change for the lip. The lower lip was found to follow the movement of the lower incisor more closely than the upper lip followed the upper incisor.

It will be noted that the variation or scatter around the diagonal line will give some explanation of why a range of actual values is expected and why the clinical values found do not always correspond perfectly with the theoretical values.

Establishment of a prediction of the range of soft-tissue change in a specific area, could greatly aid diagnosis and prognosis.

There are many areas yet to be fully evaluated and understood in conjunction with these relationships. These include such factors as growth and development, heredity, and environmental conditions. The effect of large ANB differences, the positional relationship of the upper incisor upon the lower lip, and adipose tissue was under consideration but was not fully analyzed. These factors could have some bearing upon the variations found in the predictability of the results.

With a better understanding of what to expect or to strive for in treatment, orthodontic thinking may be stimulated with respect to the soft-tissue structures around the mouth and the total esthetic facial problem, thus benefiting both orthodontist and patient.

SUMMARY

It has been found that a relationship exists between the changes in the dentoskeletal framework and the soft-tissue profile around the mouth.

By means of cephalometric x-rays, both hard- and soft-tissue structures were simultaneously analyzed, and various tracings were constructed, measured, and evaluated.

The significant findings which revealed the existence of a high degree of relationship were as follows:

1. As the maxillary incisors changed, so did (a) the superior sulcus, (b) the upper lip, and (c) the lower lip.
2. As the mandibular incisors changed, so did (a) the inferior sulcus and (b) the lower lip.
3. As the overjet and the overbite were modified, so was the upper lip to the lower lip.

It was found possible to predict the perioral soft-tissue profile changes in relation to the expected amount of anterior tooth movement.

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3563 FOURTH AVE.

In Memoriam

WILLIAM DANIEL LEE
1911-1961

WILLIAM DANIEL LEE died in Los Angeles, California, on Feb. 6, 1961, at the age of 49.

A native of Los Angeles, Dr. Lee attended the University of Southern California, where he received his B.S. and D.D.S. degrees in 1934 and his M.D.Sc. degree in orthodontics in 1937. In addition, he attended innumerable postgraduate courses and seminars.

Dr. Lee conducted an orthodontic practice in Inglewood, a suburb of Los Angeles. He had planned to take the American Board of Orthodontics examination in Denver, Colorado, this year. He served as an Army captain in the South Pacific during World War II. He was a member of the American Dental Association, the American Association of Orthodontists, the Lions Club, Alpha Lambda fraternity, and the Los Angeles Chinese Golf Club.

He is survived by his wife, Mae; a son and a daughter; his mother and father; and a brother, Dr. Alfred E. Lee (a dentist).

His zest for living, his enthusiasm, and his boundless energy were inversely proportional to his diminutive size.

Harry Cimring.

HENRY FRED WESTHOFF
1890-1961

HENRY FRED WESTHOFF of St. Louis, Missouri, died on Jan. 23, 1961. Dr. Westhoff, who was born in O'Fallon, Missouri, on Oct. 25, 1890, attended Assumption School and St. Francis Solanus College at Quincy, Illinois, from which he was graduated with highest honors in 1908. He was graduated cum laude from Washington University School of Dentistry in 1914.

In 1919 Dr. Westhoff became associated with Dr. H. C. Pollock in the practice of orthodontics and remained with him for five years, then he moved into his own office in the Missouri Theatre Building where he remained active until his death.

Dr. Westhoff was a life member of Delta Sigma Delta and held many positions in that fraternity. He served as Scribe of Upsilon Chapter. He served in the same capacity in the St. Louis Graduate Chapter from 1920 until 1933, when he was elected Grand Master. He was a member of the Supreme Council in 1938 and served as president of the Council of Deputies in 1939. In 1930 he was appointed Deputy Supreme Grand Master of Upsilon Chapter, a post he held through 1950.

Dr. Westhoff was active in the Washington University Alumni Association and served his Alma Mater for many years as an instructor in orthodontics.

He was a charter member of the St. Louis Society of Orthodontists, which was organized in 1924, and he served as its president in 1925 and again in 1931. Active since 1917 in local dental society activities, he was president of the St. Louis Dental Society in 1947. He served as chairman of general arrangements when the American Dental Association held its annual meeting in St. Louis in 1952, and at that meeting he was elected first vice-president of the A. D. A.

Dr. Westhoff was a Fellow of the American College of Dentists and a member of Omicron Kappa Upsilon (Gamma Chapter), the Executive Club of St. Louis, the Missouri Athletic Club, and the Norwood Hills Country Club. In 1920-21 he was Grand Knight of Kain Council of the Knights of Columbus.

Surviving are his wife, Verona Preiss Westhoff; two sons, D. Douglas and James; and a daughter, Denise Ann.

Another of the stalwarts of dentistry has left the scene. "Westy," as he was affectionately known, will always be missed, and he will always be remembered for the energy with which he strode through life.

Department of Orthodontic Abstracts and Reviews

Edited by
DR. J. A. SALZMANN, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York.

Craniofacial Dysostosis, Patent Ductus Arteriosus, Hypertrichosis, Hypoplasia of Labia Majora, Dental and Eye Anomalies—a New Syndrome? By Robert J. Gorlin, D.D.S., M.S., Anand P. Chaudhry, B.D.S., M.S., Ph.D., and Melvin L. Moss, D.D.S., Ph.D. Reprinted from *J. Pediat.* **56**: 778-785, June, 1960.

Numerous cases of multiple congenital facial anomalies have been observed in which there are associated dental and alveolar abnormalities. These, in part only, have been recently grouped by McKenzie[1] into the "first arch syndrome." This partitioning has separated a heterogenous collection, which includes cleft lip and palate and the syndromes of Pierre Robin[2-6] (micrognathia, glossoptosis, and cleft palate), Treacher Collins–Franceschetti-Klein syndrome or mandibulofacial dysostosis[7, 8] (mandibular hypoplasia, macrostomia, abnormalities of external and middle ear, deafness, microphthalomos, sparse eyelash development, and anti-Mongoloid obliquity of the palpebral fissures), and a host of other variations involving two or more associated signs,[9-14] such as the mandibular dysostosis of Nager-de Reynier[15] (macroglossia, defect of external ear), the hypertelorism of Greig and a similar syndrome described by Fisch and Renwick[16] (hypertelorism, different color of right and left eyes, congenital deafness, white forelock, and high palatal arch) which appears to be a forme fruste of Waardenburg syndrome.

Recently, the authors have had opportunity to examine 2 sisters who presented numerous identical congenital defects. Although the defects probably constitute a distinct, undescribed syndrome, we feel that there are certain similarities between these cases and other well-established syndromes that merit consideration.

CASE PRESENTATIONS

The patients were first seen on June 13, 1958. Because both presented almost identical anomalies, they will be described together. Their complaints were ulcers of the feet, fatigue, and facial anomaly.

G. G., a 10-year-old girl, weighed 53 pounds and was 50 inches tall, 1.5 and 1.7 standard deviations, respectively, below the norm for a girl of her age. Her 8-year-old sister, N. G., was 47 inches tall and weighed 43 pounds, both measurements being 1 standard deviation below the norm.

Present Illness.—Both girls had experienced painful ulceration near the metatarsal arch for 2 or 3 years. It was especially severe during winter, though it cleared up during warm weather. During routine examinations both girls were noted to have heart murmurs; fatigue had become more pronounced within the past few years. No cyanosis or dyspnea had ever been noted, however.

Family History.—There were 3 male half-siblings by another father. They were 14, 16, and 18 years of age, and all were normal. The mother's brother was stated to have a "large head." No other relative was known to have any congenital anomaly and there was no parental consanguinity.

Past History.—Both girls were full-term infants; both deliveries were uncomplicated. Development was noted to be "somewhat slow": they first sat at 10 months, walked at 19 months, and uttered their first words at 3 years. Their abnormal facial development was noted at birth and their defective vision, i.e., hyperopia, was diagnosed and treated by the age of 4 years. Bilateral frontal headache, though experienced by both, was more common in the older girl.

The parents indicated that both girls were doing "about average" in school.

Physical Examination.—Examination revealed that both girls had similar congenital defects. Both were short but of stocky build. Both demonstrated mild anteflexion of the head during a walking gait. The "dished out" or saddled appearance of the upper face and depressed supraorbital ridges were more pronounced in the older girl (Figs. 1 and 2). Both had a pronounced amount of coarse scalp and body hair, especially on the arms, legs, and back (Fig. 3). A small amount of coarse pubic hair was noted in both children. The scalp hair line was lower than normal. Mild umbilical hernia was observed in both girls.

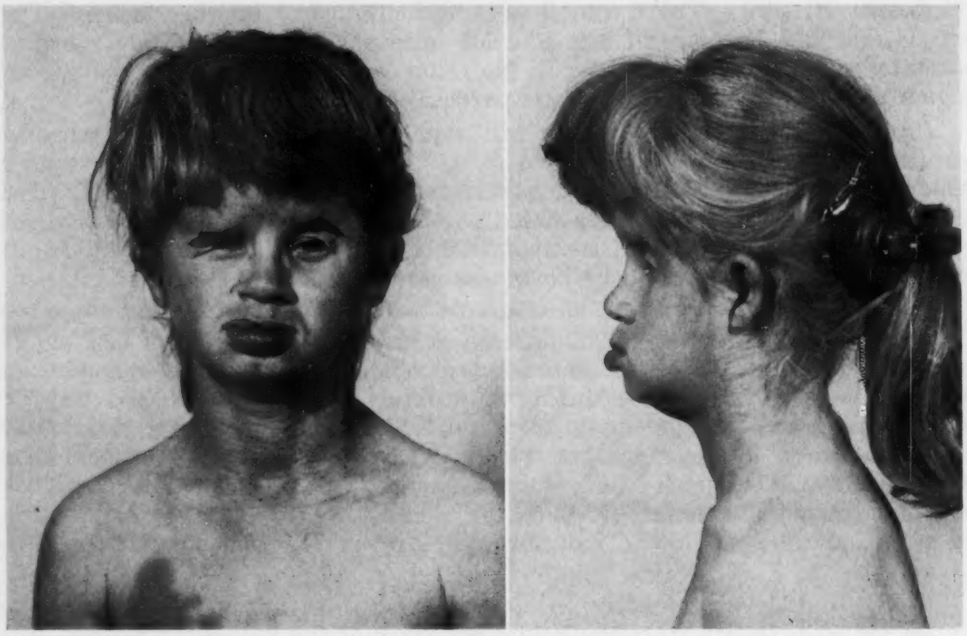
Eyes.—Lid development was defective, resulting in the inability to open or close the eyes fully. Anti-Mongoloid obliquity of the palpebral fissures could be noted, especially in the older child, as well as mild notching of the upper lids (Fig. 4). Scarring of the cornea with subsequent astigmatism was noted and thought to be secondary to improper closure. Hyperopia (20/400) was marked and considered primarily due to small globes, or microphthalmia. Reaction to light was normal, but accommodation was poor. Horizontal nystagmus was noted during an extreme lateral gaze, and the upper gaze was extremely limited. No lens abnormality was observed. The younger girl demonstrated congenital remnants of the pupillary membrane in the right eye.

Ears.—The pinna was essentially normal with a somewhat prominent preauricular fold. Narrow external orifices were noted. Mild bilateral conduction loss was noted in both girls.

Mouth.—Because of the severe dysostosis of the maxilla, zygoma and nasal bones, especially in the older child, a Class III molar relationship was present. In addition, a high-arched, narrow palate, in combination with a decrease in the number of teeth, provided poor masticating function. The maxillary tuberosities were unusually prominent. The soft palate was small. Loss of vertical height due to abnormally positioned dentition and faulty occlusion produced some ectropion of the lower lip. Several teeth exhibited microdontia. The lower incisors had well-developed mamelons due to failure of attrition. Distobuccal cusps were missing on the lower first permanent molars. The height of the body of the mandible was moderately reduced in the middle third.

In the younger girl, all 4 primary second molars were congenitally missing, and in the permanent dentition all second bicuspids and upper first bicuspids were congenitally absent. In the case of the older girl, 3 permanent first molars, all permanent second and third molars, mandibular second bicuspids, and all maxillary permanent bicuspids were missing.

In both children the crowns of the teeth were bell shaped with short, spindle-shaped roots (Fig. 5). The pulp chambers were small or missing in some teeth. Some unerupted permanent teeth were vertically oriented and a large distance separated them from their resorbing predecessors. Carious lesions were conspicuously absent.



A. B.

Fig. 1.—*A* and *B*, Frontal and lateral views of older sister, G. G., age 10. Note hypertrichosis, ectropion of lower lip, "dished out" appearance of middle face, anti-Mongoloid obliquity of palpebral fissures, and eyelid anomaly.

A. B.

Fig. 2.—*A* and *B*, Frontal and lateral views of younger sister, N. G., age 8. Marked overgrowth of scalp hair is evident. Lack of development of middle face is not as evident as in older sister.

Cardiac Anomaly.—Grade III and IV "machinery-like" murmurs were noted in the elder and younger girl, respectively. Thrills, loudest at the 2 to 3 intercostal space, were interpreted as patent ductus arteriosus. Surgical examination confirmed this opinion, and repair with essentially uneventful recovery followed.

Laboratory Findings.—Blood urea nitrogen, carbon dioxide combining power, chloride, phosphate, sodium, potassium, cholesterol, alkaline phosphatase, and protein-bound iodine were all found to be normal.

Fig. 3.—Hirsutism of older girl. Marked lanugo hypertrichosis extends to involve face.

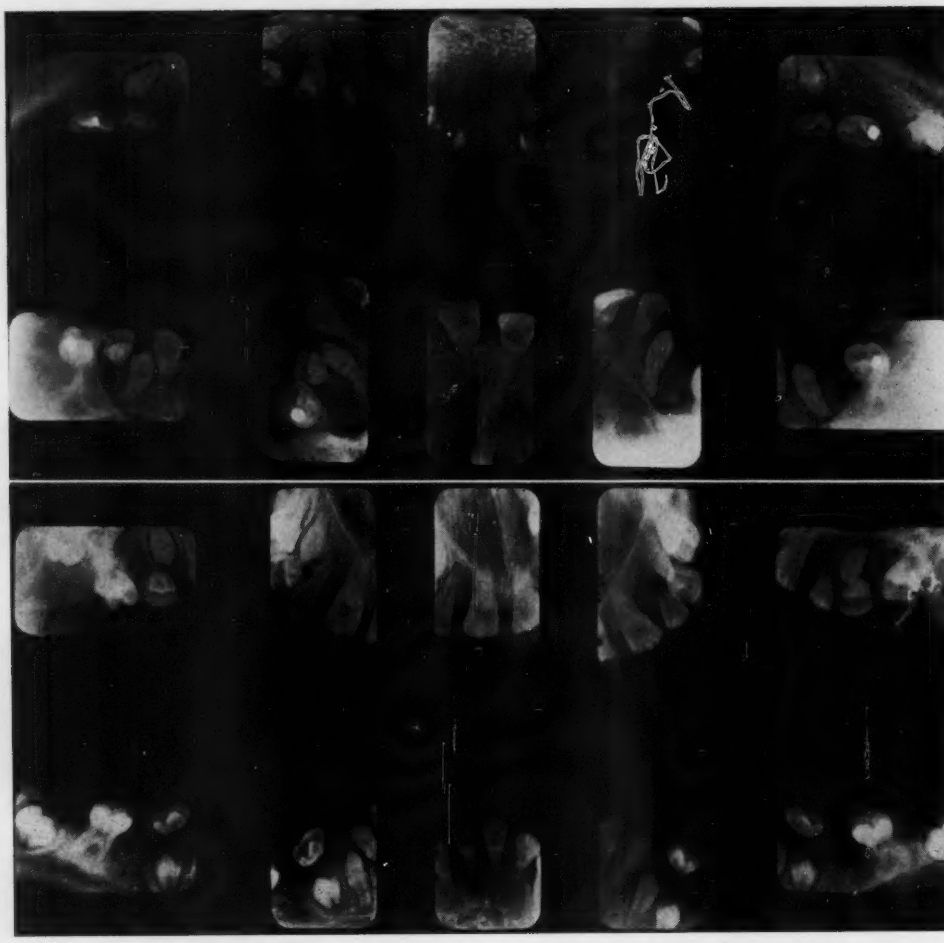
Fig. 4.—Defective upper eyelid development of older girl. Note notch at arrow.

Genital Examination.—Both girls had extreme hypoplasia of the labia majora, the fourchette gaping widely (Fig. 6). The vaginal and urethral orifices were normal, however.

Roentgenographic Examination.—The sisters demonstrated differing degrees of similar malformations of the neuro- and splanchnocranium, including premature synostosis of the coronal suture, lordosis of the petrous ridges, absolute clival hypoplasia, elevation of the lesser sphenoidal wings, brachycephaly, and relative occular hypertelorism. The maxillary and nasal bones were underdeveloped with some asymmetric development of the sphenoid. These changes led to a *general* diagnosis of craniofacial dysostosis (Figs. 7 and 8).

Analysis was carried out by methods previously described in detail by Moss and co-workers[17-21] in several papers. It is quite evident that neither girl presented all of the signs characteristic of solitary premature synostosis of the coronal suture.[21] The characteristic clival hypoplasia, however, was evident in both cases.

A.



B.

Fig. 5.—*A* and *B*, Dental roentgenograms of G. G., age 10, and N. G., age 8, respectively. Note widespread diastemas, congenitally missing teeth, malformed unerupted permanent teeth, cervical construction of mandibular incisors, and diminution of pulp chambers and canals.

In general, the older girl was more severely deformed. Her posterior cerebral fossa was more deeply situated, with consequent alteration in the plane of the foramen magnum. This plane extended obliquely downward and backward, instead of being identical with the plane of the hard palate.[22] A marked basal kyphosis was also apparent. There was reason to suspect that this was due to secondary "postural flattening" superimposed on the unilateral coronal synostosis. The splanchnocranium was also more severely deformed presenting a most unusual sinuosity of the hard palate.

DISCUSSION

Etiologically, the petrous lordosis, the basal kyphosis, and the shifting of the foramen magnum are secondary mechanical results of an alteration in the direction of growth of the brain brought about by the other primary basal congenital malformations.

These two girls can be compared in many respects with those described as having the Treacher Collins–Franceschetti-Klein syndrome. In this syndrome there is hypoplasia of the malar bones and mandible. Malformation of the external and internal ear and deafness are common in the "first arch syndrome." Hearing was somewhat reduced in both girls and narrow external orifices were noted, especially in the older girl.

A. *B.*

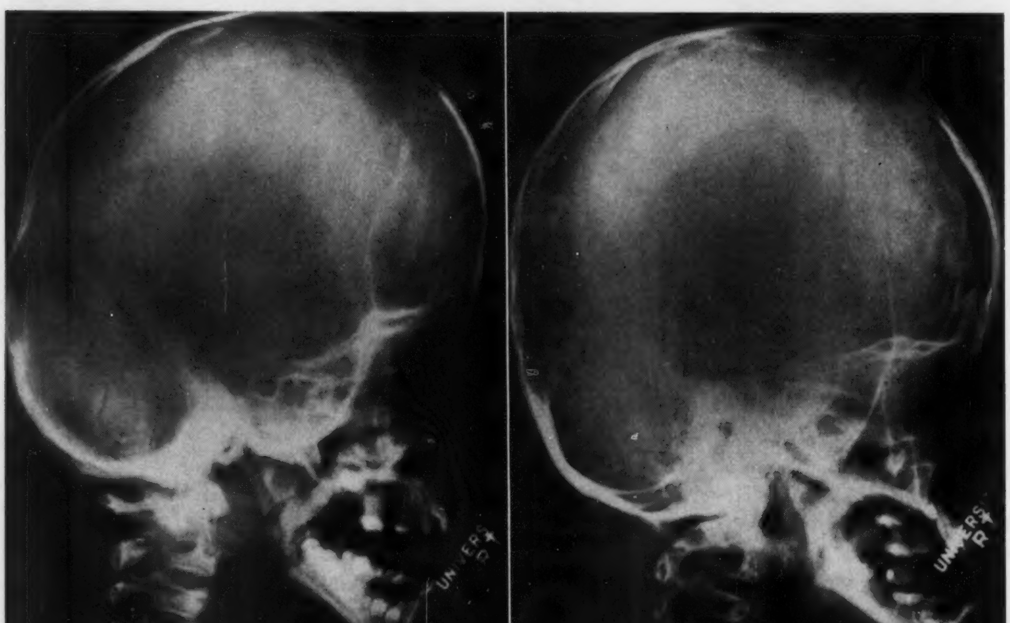
Fig. 6.—*A* and *B*, Genital area of G. G. and N. G., respectively. Note lack of development of labia majora with gaping fourchette. Pubic hair development, present in both, was marked in older girl.

High palate and abnormal position and occlusion of the teeth are also common to both disorders. On the other hand, neither sister exhibited macrostomia nor were blind fistulas present between the angle of the mouth and ear as seen in the Treacher Collins syndrome. Although both sisters exhibited hirsutism, profuse hair growth in the form of tongue-shaped processes extending to the cheeks was not noted. Both girls had eyelid anomalies, the older sister demonstrating the anti-Mongoloid obliquity of the palpebral fissures particularly well. Notching was also noted in this sister. In addition, both girls seemed to have "incomplete lid development," i.e., there was not enough lid to completely cover the eye, which produced secondary corneal opacity. Both had essentially normal mental development as demonstrated by clinical testing of their intelligence quotients.

The dental anomaly was most unusual. The teeth, on purely external appearance, were somewhat translucent and gray, not unlike those seen in dentinogenesis imperfecta. The teeth in this latter condition characteristically

A. B.

Fig. 7.—*A* and *B*, Roentgenograms of N. G. and G. G., respectively. Both sisters show similar malformations of neuro- and splanchnocranium. Brachycephaly, relative ocular hypertelorism, maxillary and nasal bone underdevelopment, and some asymmetric development of sphenoid are evident.



A. B.

Fig. 8.—*A* and *B*, Lateral view of N. G. and G. G., respectively. Note premature synostosis of coronal sutures, lordosis of petrous ridges, abnormal clival hypoplasia, and elevation of lesser sphenoidal wings.

do not have root chambers and canals and have narrow tapering roots with cervical constriction. Examinations of their dental roentgenograms reveal some root constriction, especially of the lower incisors. Root canals were present but somewhat diminished in width.

Congenital absence of teeth was marked in both girls. Böök,[23] in 1950, reviewed hypodontia and proposed a new symptom complex designated as the PHC syndrome which included premolar hypodontia, hyperhidrosis of the palms and soles, and canities or premature whitening of the hair. Neither excessive sweating nor canities was seen in our cases. White forelock is seen in the Fisch-Renwick[16] and Waardenburg[25] syndromes. Cotterman and Falls[24] also observed white forelock in Bonneive-Ullrich syndrome as well as microdontia. Hypodontia has been cited as being present in the Franceschetti-Klein syndrome,[8] and many of the oral and facial anomalies in these sisters seem to be compatible with that diagnosis.

Although in these two cases we appear to be dealing with a symptom complex that would include the "first arch syndrome," we question the wisdom of grouping a large number of etiologically different conditions under the anatomical location in which the developmental error has occurred. By analogy, little would be added if "all malformations of the lower limbs were grouped as the 'lumbar myotome syndrome.' "[26]

From these two cases it is impossible to ascertain whether all the anomalies observed could be predicated upon a single pleiotropic gene or multiple, closely linked, genes. A single gene can produce any combination of signs and symptoms, the limits being the specificity of the chemical reaction involved, its time of action, and the states of differentiation of the cells, tissues, or organs involved.

SUMMARY

Two cases are described which present craniofacial dysostosis, patent ductus arteriosus, hypoplasia of the labia majora, and dental anomalies. The relationship of the new syndrome to that of other well-recognized symptom complexes and the dubious value of grouping a large number of etiologically different conditions under the "first arch syndrome" are discussed.

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Recent Advances in the Study of the Structure, Composition, and Growth of Mineralized Tissues: By Roy O. Greep and Albert E. Sobel (Conference Co-Chairman), W. D. Armstrong, L. F. Bélanger, R. C. Greulich, S. B. Hendricks, H. C. Hodge, C. P. Leblond, P. L. Munson, W. F. Neuman, R. A. Robinson, D. B. Scott, J. H. Shaw, R. F. Sognnaes, M. V. Stack, O. R. Trautz, M. L. Watson, J. H. Weikel, Jr., and L. Wilkins. (Edited by Roy Waldo Miner; Consulting Editor—Roy O. Greep.) New York, 1960, published by the Academy. Vol. 60, Art. 5, pp. 541-806. *Ann. New York Acad. Sc.* Price, $4.00.

Studies of the hard tissues by electron microscopy, x-ray diffraction, histochemistry, radiobiology, and microchemical and crystallographic methods have made possible the understanding of the ultimate character of bone and teeth. It is now recognized that the bones and teeth are dynamic structures which metabolize, adapt, and respond to constant change. In addition, they contribute to the ionic equilibria of the body fluids. This monograph presents the present state of knowledge concerning these mineralized tissues.

Constitutional factors are important in skeletal development and growth potential. Important also are heredity, hygiene, diseases, food habits, and even mental health.

Sognnaes found that in contrast to bone, with its microscopic landmarks of osteoblastic and osteoclastic remodeling, the cementum and dentin of functioning teeth are normally subject only to apposition whereas the acellular and avascular enamel is completely protected from microscopically demonstrable remodeling. Knowledge of the foregoing is important to the understanding of differences between bone, cementum, dentin, and enamel. This subject is treated further by Scott, Stack, Robinson, and Watson.

Leblond, Bélanger, and Greulich, of McGill University, discuss the formation of bones and teeth as visualized by radioautography, a method which permits the observance of fine details of matrix formation and mineral deposition. They conclude: "Except for an interstitial deposition of minerals in the dentin and bone of very young animals, the addition of minerals, as well as the formation of matrix, takes place by apposition of successive layers, that is, by accretion."

Recrystallization in bone mineral was found by Neuman and Weikel to take place in the young animal, where the growth process dominates the dynamics of calcium metabolism in the skeleton.

The effects of nutritional factors on bones and teeth are discussed in an important chapter by Shaw of the Harvard School of Dental Medicine. Shaw points out that knowledge of the effects of nutrition on the development and calcification of the bones and teeth is still in its infancy. After discussing the various nutritional elements responsible for tooth decay, Shaw concludes that fluorides in water supplies (around 1 p.p.m.) are beneficial to dental health and have not been found detrimental to general health.

Wilkins, of Johns Hopkins, reviews hormonal influences on skeletal growth and discusses some of the clinical aspects of disturbed osseous development.

Those interested in a better understanding of the structure, composition, and growth of bones and teeth will find this monograph of inestimable value.

J. A. S.

Calcification in Biological Systems; a Symposium Presented at the Washington Meeting of the American Association for the Advancement of Science. Dec. 29, 1958: Edited by Reidar F. Sognnaes, Harvard School of Dental Medicine. Washington, D. C., 1960, Publication No. 64 of the American Association for the Advancement of Science. 511 pages, illustrated. Price, $9.75.

This volume is based on a symposium held during the 125th annual meeting of the American Association for the Advancement of Science. The symposium was organized by A.A.A.S. Section Nd (Dentistry) and cosponsored by the Sections on Medicine and Zoology, the North American Division of the International Association for Dental Research, the American Dental Association, and the American College of Dentists.

Fully one-half of the participants were from biologic fields outside of dental schools. As a group, the contributors may be considered among the leaders in histology, embryology, pathology, anatomy in its special relation to dental and oral structures, zoology, biochemistry, and radiation as related to medicine and dentistry.

Beginning with a consideration of the calcification of unicellular organisms, the text proceeds to the discussion of crustacea and the usual laboratory animals before the dental tissues and bones are discussed.

In the chapter on "Calcification of Dental Tissues With Special Reference to Enamel Ultrastructure," by Frank, Sognnaes, and Kern, there is an explanation of the structural basis of the hard dental tissues as compared to bone. A résumé of the histologic and pathologic aspects of the formation of adult human enamel is presented.

The ability of dentine matrix to act as a seed for mineral material is explained, and the hypothetical mechanisms of the calcification of dentine at the molecular level are discussed.

In the discussion of hydrolytic enzymes in dentinogenesis and osteogenesis, Burstone found that alkali phosphatase demonstrates a high activity in the early stages of osteoblastic differentiation and development. Osteoclastic action is associated with acid phosphatase. A description of the calcification of cartilage, which forms a scaffolding on which the skeleton can be deposited, is presented.

The inorganic crystals that form in the five normally calcifying tissues in vertebrates (bone, dentin, epiphyseal cartilage, cementum, and enamel)

have the general formula $Ca_{10}(PO_4)_6\ OH_2$. The way in which these crystals are deposited in their organic matrices is described, and hypotheses are presented on the calcifiability of matrices.

Moss, of Columbia University, writing on "Experimental Induction of Osteogenesis," states that an age factor is involved in osteogenesis. Either the responding cells totally lose their competence or the inductive agent is not strong enough to affect them at a later age.

Those interested in current concepts of mineralization of calcified tissues will find in this text the sources of current knowledge on the subject.

Practical Orthodontics: By George M. Anderson, D.D.S., Sc.D., formerly Professor of Orthodontics, Baltimore College of Dental Surgery, Dental School, University of Maryland, Baltimore, Md. (Collaborator: Paul A. Deems, D.D.S., former Associate Professor of Clinical Oral Pathology, former Associate Professor of Dental Anatomy, and former Instructor in Clinical Orthodontics, Baltimore College of Dental Surgery, Dental School, University of Maryland, Baltimore, Md.) Ninth edition. St. Louis, 1960, The C. V. Mosby Company, 738 pages, with 719 illustrations. Price, $18.00.

The ninth edition of this text presents a comprehensive revision by the internationally known orthodontist, George M. Anderson. This text will prove equally beneficial to dental students, graduate school students, dentists beginning orthodontic practice in association with an experienced orthodontist under the preceptorship program, and orthodontic specialists. The general practitioner will find it a fruitful source of reference material. Dr. Anderson has distilled in concise form, the latest orthodontic research and clinical techniques in the world. Using the judgment developed during forty years of practice and teaching, Dr. Anderson impartially presents, in logical sequence, the theory and practice of various methods of treatment.

The expert presentation of conflicting opinions adds to the comprehensive evaluation contained in this textbook and shows that effective results can be obtained by more than one method. Of particular significance are the sections on skeletal classification of malocclusion, muscular disharmonies, utilization of serial extraction, the use of removable plates, and the development of light wire forces. These sections offer new methods of treating complex and intricate orthodontic problems.

Another feature worthy of note is the compartmentalization of the various chapters. It is possible to read and comprehend each subject as an entity, including a complete and separate treatise, without reading the book from cover to cover to get an over-all meaning.

Dr. Anderson and his collaborator, Paul Deems, have effectively made use of four contributors who are specialists in their various fields of medicine and dentistry to handle specialized problems related to orthodontics.

This textbook is a major contribution to orthodontic knowledge and contains the best in orthodontic theory and practice. The accelerated rate of development of new ideas and techniques advancing the science and art of orthodontics dictates a periodic revision of texts to eliminate the obsolete and to incorporate advanced thinking. Orthodontics is indebted to Dr. Anderson for his exhaustive examination of new theory and techniques which have

been so carefully sifted with logic and proven judgment. This splendid ninth edition of Practical Orthodontics is sure to prove of value to any dentist interested in orthodontics.

The reviewer would, without reservation, recommend this textbook to anyone interested in orthodontics. It very definitely fulfills its objective.

Gerard A. Devlin.

Orthodontics in General Dental Practice: By Gordon C. Dickson, B.Ch.D. (Leeds), F.D.S.D. Orth., R.C.C.(Eng.), Orthodontic Consultant to the Portsmouth Hospital Group, formerly Orthodontic Consultant to Birmingham Regional Hospital Board. London, 1959, Pitman Medical Publishing Co., Ltd. 337 pages, illustrated. Price, 75 shillings.

Orthodontic Notes: By D. P. Walther, M.R.C.S., L.R.C.P., L.D.S., R.C.S. (Eng.), D. Orth., R.C.S., Reader in Orthodontics, University of London; Director and Head of the Orthodontic Department, the Royal Dental Hospital of London. Bristol and Baltimore, 1960, John Wright & Sons, Ltd., and Williams & Wilkins Company. 198 pages, illustrated. Price, $4.75.

These two texts are reviewed together because they are very much alike. Walther's book is intended for dental students and is based on notes taken from lectures to students at the Royal Dental Hospital, School of Dental Surgery, London. Dickson's book is intended primarily for the general dental practitioner. As Dickson points out in his preface, he found it necessary to present "only one view where several views existed" and to be "dogmatic where dogmatism was not felt or intended."

In spite of disclaimers by both authors, it is problematical that the student and general practitioner will accept these books for what they really are—digests of an introduction to orthodontics. If a little knowledge is a dangerous thing, then the danger increases as the little knowledge is made to cover a wider field. Both texts cover much ground but only in summary fashion. References to source books are scant and frequently lacking in both volumes. Both authors acknowledge the fact that they present nothing new.

Dickson's book contains more on the use of removable appliances than Walther's, but neither volume presents the subject in detail. American methods are omitted or given only cursory mention. Both volumes repeat many statements that are no longer accepted in orthodontic circles (for example, the invariability of the freeway space, and statements on sutural growth).

A valuable feature of Dickson's book is a description of the removable appliances of C. P. Adams. These are ingenious appliances which Adams describes at some length in his own text.

English undergraduate dental students and dental practitioners who are preparing to practice under the National Health Insurance Act will find much useful information in both books. As the authors state, these texts are only a beginning and are not intended as definitive texts.

Oral Anatomy: By Harry Sicher, M.D., D.Sc., Professor of Anatomy and Histology, Loyola University School of Dentistry, Chicago College of Dental Surgery, Chicago, Illinois; Guest Lecturer, Northwestern University Dental School, Chicago, Illinois; Special Lecturer, University of Nebraska Dental School, Lincoln, Nebraska; Visiting Professor, University of Puerto Rico Dental School, San Juan, Puerto Rico. Third edition. St. Louis, 1960, The C. V. Mosby Company. With 314 text illustrations, including 25 in color. Price, $13.50.

In this standard text the author has made special effort to correlate function and morphology. He has tried at all times to bridge the gap between theory and practice and to prove that anatomic understanding aids clinical procedures. Applied anatomy is presented in a separate part of the book. Here the subject is discussed according to clinical requirements, and not in the usual divisions of the human body. All of the foregoing is in keeping with modern trends in the teaching of anatomy.

The developmental anatomy of the human skull is discussed and illustrated. This feature of the text should be of especial interest to orthodontists. Growth of the facial skeleton is discussed from the histologic as well as the gross anatomic points of view. The contributions of orthodontics to the description of facial growth are considered. The muscles of the head and neck and the temporomandibular articulation are described. Special attention is given to the opening and closing of the mandible. The four positions of the mandible (rest position, occlusal position, hinge position, and centric position) are defined and analyzed. With regard to the constancy of the rest position, which is now generally questioned, Sicher points out: "Muscle tonus itself, and, therefore, rest position of the mandible is constant under equal conditions, except, for instance, in disease, overwork, or nervous tension. One should keep in mind, however, that constancy in a living organism means simply that the range of variations or variability is negligible."

Many other influences could have been mentioned, not the least among which is loss of teeth.

Throughout this text the same excellence of presentation and illustrations have been maintained that we have become accustomed to finding in Sicher's books.

News and Notes

New Central Office of the American Association of Orthodontists

The accompanying photographs show the newly established central office of the American Association of Orthodontists. This office provides a repository for the records of all members of the American Association of Orthodontists, both past and present. It also provides work room for mailing operations, space for Committee and Board meetings, and administrative facilities.

Fig. 1.—The Board and Committee meeting room.

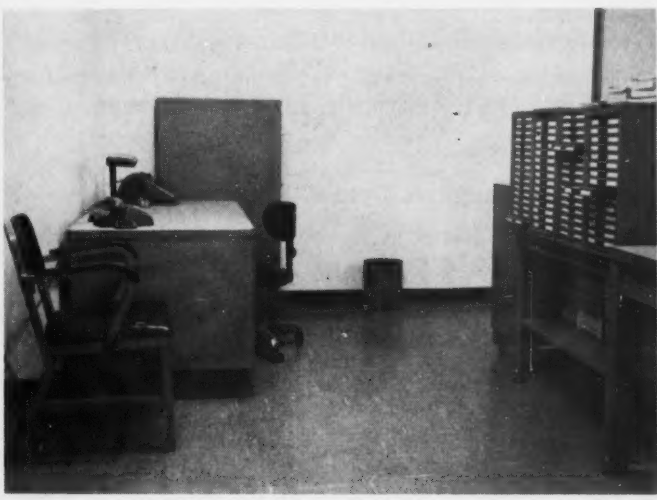

Fig. 2.

Fig. 3.

Fig. 2.—The assistant secretary's desk and Cardex-Addressograph files.
Fig. 3.—The general files of the American Association of Orthodontists and a map which outlines the borders of the sectional societies of the A. A. O.

The photographs on the wall of the Board room are those of A. A. O. presidents who have served over the past twenty-one years.

The office is administered by the A. A. O. secretary, Earl E. Shepard, and assistant secretary, Mrs. Pat Kerr.

Great Lakes Society of Orthodontists

Officers of the Great Lakes Society of Orthodontists for the coming year are as follows:

President, Paul Ponitz, 914 Security Bank Bldg., Battle Creek, Mich.

President-Elect, George S. Harris, 18520 Grand River, Detroit, Mich.

Vice-President, Robert Coleman, David Whitney Bldg., Detroit, Mich.

Secretary, Edward A. Cheney, Medical-Dental Bldg., 2909 Grand River, Lansing, Mich.

Treasurer, Carl J. Ericsson, 14805 Detroit Ave., Lakewood, Ohio.

Director, Harlow L. Shehan, Jackson City Bank Bldg., Jackson, Mich.

The next meeting of the Society will be held at the Eden Roc Hotel in Miami Beach, Florida, Nov. 12 to 17, 1961.

Northeastern Society of Orthodontists

The following officers have been elected for the coming year:

President, Irving Grenadier, 888 Grand Concourse, New York, N. Y.

President-Elect, William R. Joule, 549 High St., Newark, N. J.

Vice-President, Everett A. Tisdale, 230 Beacon St., Boston, Mass.

Secretary-Treasurer, David Mossberg, 36 Central Park South, New York, N. Y.

Sectional Editor, Joseph D. Eby, 121 East 60th St., New York, N. Y.

Assistant Editor, Brainerd F. Swain, 28 DeHart St., Morristown, N. J.

Historian, Leuman M. Waugh, Betterton, Kent County, Md.

The Society will hold its fall meeting at the Hotel Manger in Rochester, New York, Oct. 29 to 31, 1961.

Pacific Coast Society of Orthodontists

The Pacific Coast Society will hold its annual meeting Aug. 6 to 10, 1961, in Seattle, Washington, under the presidency of E. Allen Bishop, 703 Cobb Bldg., Seattle, Washington.

Orthodontic Section of the Canadian Dental Association

The Orthodontic Section of the Canadian Dental Association is holding a three-day meeting in Saskatoon, Saskatchewan, June 4, 5, and 6, 1961, in conjunction with the convention of the Canadian Dental Association.

The program will include the following:

One Orthodontist Takes Stock of Cephalometrics. Wendell L. Wylie.

The George Wellington Grieve Memorial Lecture: A Reappraisal of the Orthodontist as a Specialist. Wendell L. Wylie.

Continuous Force Techniques as Related to the Begg Technique. Morris M. Stoner.

All members of the American Dental Association are cordially invited to attend this meeting. No extra registration fee will be levied for registrants at the convention. A fine social program has been planned with the usual Western hospitality.

For further information, write Dr. J. J. Schachter, 209 Canada Bldg., Saskatoon, Saskatchewan.

Denver Summer Meeting
for the Advancement of Orthodontic Practice and Research, Inc.

The twenty-fourth annual Denver Summer Meeting will be held July 30 to Aug. 4, 1961, at Writer's Manor in Denver, Colorado. The following outstanding program has been arranged by the Board of Trustees:

Maury Massler, D.D.S., M.S.

1. Oral Habits: Origin, Evolution, and Management
   A. Sucking Habits
   B. Biting Habits
   C. Tongue and Lip Habits
2. The Adolescent Looks at Orthodontia
3. Radiographic Interpretations of Bone Changes Incident to Tooth Movement
   A. Changes in the Lamina Dura
   B. Estimating the Resorption Potential of Bone and Root

Robert M. Ricketts, D.D.S.

Cephalometrics

Harry W. Tepper, D.D.S.

Dynamic Functional Therapy—The Orthodentor by Bimler
   A. Philosophy of Functional Therapy
   B. Mode of Action
   C. Advantages for Orthodontist and Patient

Joseph A. Fitzpatrick, Ph.D., and David Stone, B.S., D.D.S.

1. Adverse Swallowing, a Pattern of Tongue Thrusting Related to Dental Malformation
2. Causes, Recognition, and a Treatment Using the Speech Therapist to Restore the Muscles and Patterns in Swallowing

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Australian Society of Orthodontists*

YOUR PRESIDENT SAYS

A trend over recent years has been the restriction of their practices by a number of dentists. This has resulted in the development of so-called specialties within the practice of dentistry. Originally these were few in number and with few followers, but recently there has been an effort to have some established as full specialty areas.

Organised dentistry has paid close attention to these developments and over the years the matter has been continually before the House of Delegates of the American Dental Association. This body has seen fit to name areas of specialty practice and has under consideration a method for the uniform and standard recognition of specialists.

This latter proposal has been bitterly opposed by the various specialty boards as each applies its own standard to their particular specialty. The American Board of Orthodontics in particular has been very active in the opposition to this proposal in its present form.

These boards have made a great contribution to raising the standard of the specialists in training, in respect by the professions, and in their position within the community. They have given advice on the establishment of graduate training programmes and have suggested minimum educational requirements. This has resulted in the continual improvement of graduate programmes, which in turn has established an extremely high standard for specialist practice.

While the establishment of an Orthodontic specialty Board might be something for the future and, I hope, the not far distant future, we should all keep in mind the principles

*Excerpts from the *Bulletin of the Australian Society of Orthodontists.*

and ideals behind such. We could well contemplate the question of graduate training programmes, standards required for registration as a specialist, clinical research, to mention a few.

Is it not now the time to consider these propositions, is it not now the time to discuss them?

109 Elizabeth Street, *Sydney.* — Robert Y. Norton, *President.*

FIRST AUSTRALIAN ORTHODONTIC CONGRESS
SYDNEY, AUG. 9-11, 1961.

The twin arch mechanism has many devoted advocates and Dr. V. P. Webb, who is particularly well versed in its techniques, will talk on the particular philosophy behind the use of this method of fixed appliance treatment. Dr. R. W. Halliday, who recently made a flying visit to the U. S. A. to study the latest developments in twin wire therapy, will open the discussion.

Probably more has been written in the last few years on the use of extra oral anchorage than any single subject in the orthodontic literature, and it is now widely used for many different purposes in Australia. Mr. Seward has some cephalometric evidence of its effectiveness and will, no doubt, bring this into his lecture.

NEW ZEALAND ORTHODONTIC SOCIETY

Copies of the *Bulletin of the Australian Society of Orthodontists* were sent to the New Zealand Orthodontic Society and other overseas orthodontic societies.

Particular enthusiasm was expressed by the New Zealanders and several members of this Society plan to attend the First Australian Orthodontic Congress.

International Dental Congress

Dentists who expect to attend the International Dental Congress will be interested in learning that word has been received concerning the Congress, which will be held in Cologne, Germany, July 7 to 14, 1962, by Fédération Dentaire Internationale. Since the Congress will be in the middle of the summer, it is highly important that plans be made as far in advance as possible. Information may be obtained by writing Dr. Obed H. Moen, president of the organization and treasurer of the U.S.A. Section, at 6 Main St. Watertown, Wisconsin. Information concerning special tours may be obtained from Dr. C. W. Carrick, Travel Consultant for the U.S.A. Section, 5 South Main St., Oberlin, Ohio, or from any American Express office or reputable travel agency.

European Cleft Palate Authority to Lecture in the United States

Dr. Rudolf K. Stellmach of the Department of Maxillo-Facial and Plastic Surgery of the Medical Academy in Düsseldorf, Germany, will be in the United States on an extended lecture tour. His subject is "The Orthodontic Management of Infants With Cleft Palates." He will also discuss the surgical procedures used in treating infants with bilateral cleft palates. The itinerary of Dr. Stellmach's lecture tour is as follows:

Boston, Massachusetts	April 28, 1961	Tufts University
(This is the annual Margolis Lecture)		Boston University
Chicago, Illinois	May 5, 1961	University of Illinois
Seattle, Washington	May 12, 1961	University of Washington
Houston, Texas	May 26, 1961	University of Texas
Memphis, Tennessee	June 2, 1961	University of Tennessee
New York City, N. Y.	June 9, 1961	New York University

Those interested in attending the lectures will kindly contact the host institutions.

Orthodontist Heads New York Academy of Dentistry

Norman L. Hillyer, orthodontist of Hempstead, New York, has been installed as president of the New York Academy of Dentistry for the fiscal year 1961-1962. For many years Dr. Hillyer has been a director of the American Association of Orthodontists.

New Water Fluoridation Study Reported

Studies of twenty-three female puppies that regularly imbibed fluoridated water over a period of three and one-half years have shown that the general health and well-being of the animals were not affected.

A report on the study, carried on at the University of Wisconsin, was made at the International Association for Dental Research on March 25, 1961, by Dr. Roy E. Wuthier, now a Research Fellow at the Forsyth Dental Infirmary in Boston.

Dr. Wuthier divided the puppies into five groups. One was a control group which received untreated distilled water and a low-fluoride diet. Animals in the four remaining groups drank water treated with 1.0, 1.2, 2.4, and 3.6 ppm of fluoride.

The incidence of dental decay in all of the dogs, including the untreated group, was very low, Dr. Wuthier reported. The severity of periodontal disease, tooth wear, dental calculus formation, and mottling of the tooth enamel was unaffected by these fluoride treatments. Also, none of the other factors considered in the research were affected adversely. These factors included growth rate, maintenance of body weight, and reproductive performance (that is, size of litters, health and survival of the litters, and lactation ability of the mothers). No pathologic effects were noted in the skeletal systems of the dogs receiving fluoride in their diet, although their bones showed an increase in fluoride uptake ranging up to thirty times above the fluoride found in the bones of the control animals.

This study was done by Dr. Wuthier and Dr. Paul H. Phillips of the Department of Biochemistry, University of Wisconsin.

Shailer Peterson Appointed Dean of University of Tennessee College of Dentistry

Dr. Shailer Peterson of Chicago, assistant secretary for educational affairs of the American Dental Association, has been appointed dean of the University of Tennessee College of Dentistry, effective June 1, 1961.

The announcement was made jointly by Dr. O. W. Hyman, Memphis, vice-president of the University, and Dr. Harold Hillenbrand, Chicago, secretary of the A. D. A.

Dr. William Jolley, who has been serving as acting dean, will become associate dean on June 1. Dr. James Ginn, who had served as dean for eight years, died in November, 1959.

Dr. Peterson, who also serves as secretary of the Association's Council on Dental Education, holds a Ph.D. in educational psychology. He will be the third nondentist to serve as a dental school dean, the others being at Harvard University and at Washington University in St. Louis.

Notes of Interest

William E. Dahlberg, D.D.S., announces the opening of his new office at 633 North Central Ave., Glendale, California, practice limited to orthodontics.

Lee R. Logan, D.D.S., M.S., announces that his practice at 7012 Reseda Blvd., Reseda, California, is limited to orthodontics.

Leon H. Strohecker, Jr., D.D.S., announces the opening of his office at 538 East Main St., Landsdale, Pennsylvania, practice limited to orthodontics.

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American Association of Orthodontists
(Next meeting April 28—May 3, 1962, Los Angeles)

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President-Elect, Dallas R. McCauley - - - - - - 410 S. Beverly Dr., Beverly Hills, Calif.
Vice-President, Cecil G. Muller - - - - - - - - 101 S. 35th Ave., Omaha, Neb.
Secretary-Treasurer, Earl E. Shepard - - - - - - - 225 South Meramec, Clayton, Mo.

Central Section of the American Association of Orthodontists
(Next meeting Oct. 1-3, 1961, Minneapolis)

President, Henry E. Colby - - - - - - - 1850 Medical Arts Bldg., Minneapolis, Minn.
Secretary-Treasurer, Kenneth E. Holland - - - - - 1016 Sharp Bldg., Lincoln, Neb.
Director, G. Hewett Williams - - - - - - - - - - - - 811 Elm St., Winnetka, Ill

Great Lakes Society of Orthodontists
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Pacific Coast Society of Orthodontists
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Director, Ernest T. Klein - - - - - - - - - - - 707 Republic Bldg., Denver, Colo.

Southern Society of Orthodontists
(Next meeting Nov. 5-8, 1961, St. Petersburg)

President, Charles E. Harrison - - - - - - - - - - 362 Sixth St., S., St. Petersburg, Fla.
Secretary-Treasurer, William H. Oliver - - - - - - - 1915 Broadway, Nashville, Tenn.
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Southwestern Society of Orthodontists
(Next meeting Oct. 22-25, 1961, Dallas)

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Director, Nathan Gaston - - - - - - - - - - - - - - 701 Walnut St., Monroe, La.

American Board of Orthodontics
(Next meeting April 10-15, 1961, Denver)

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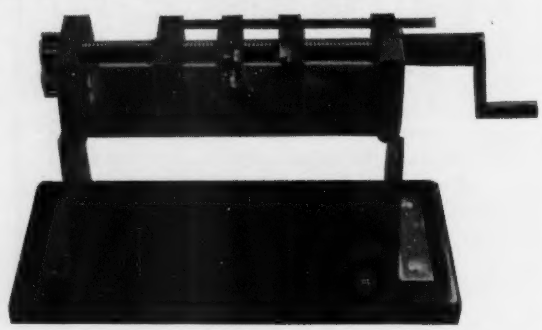

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